THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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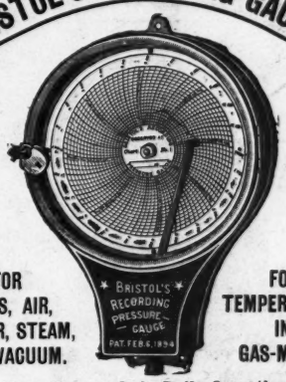

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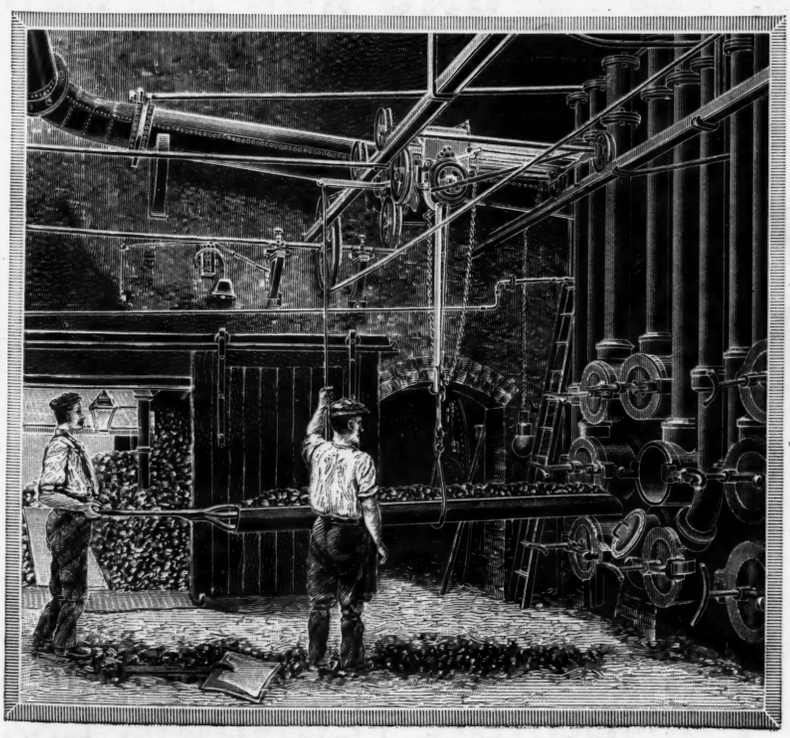

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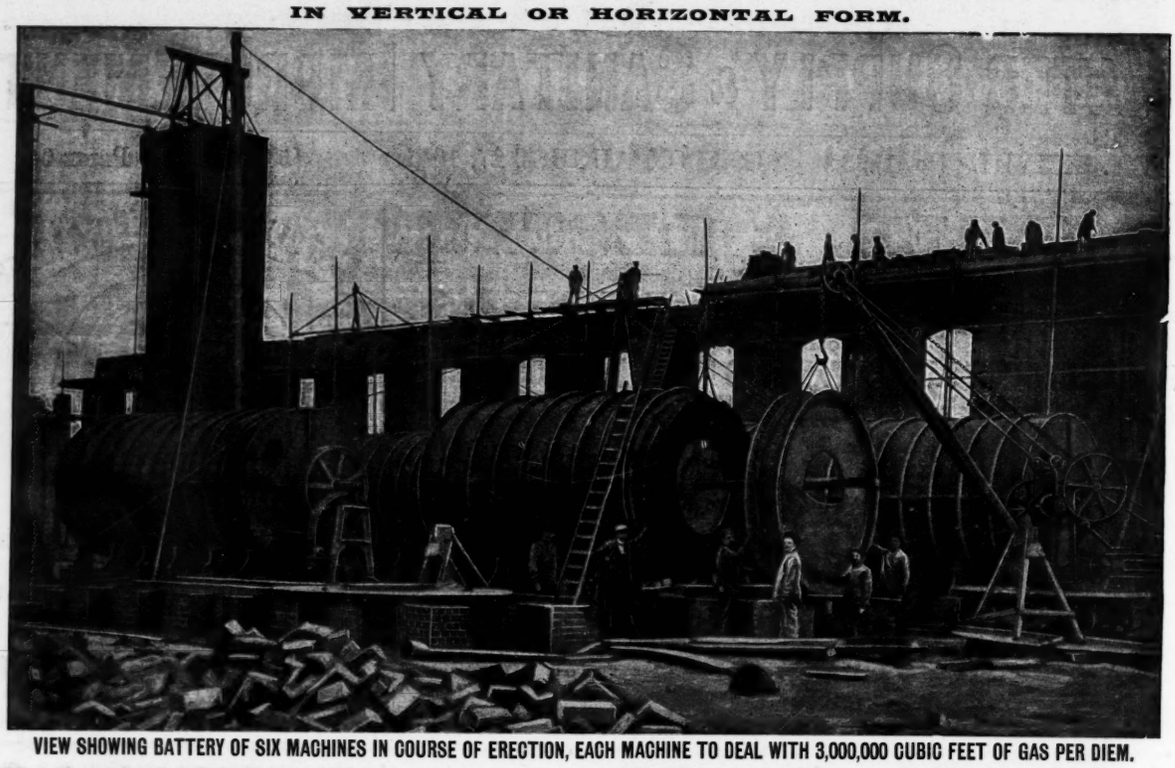

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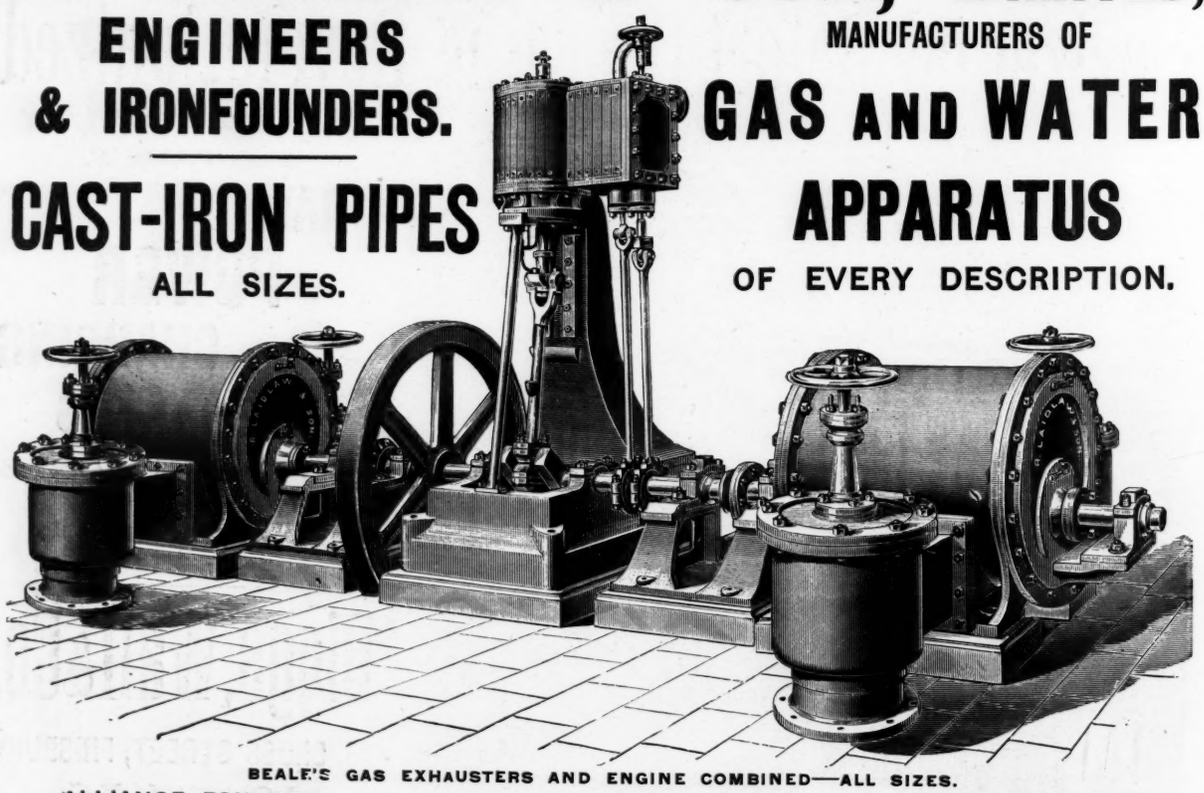

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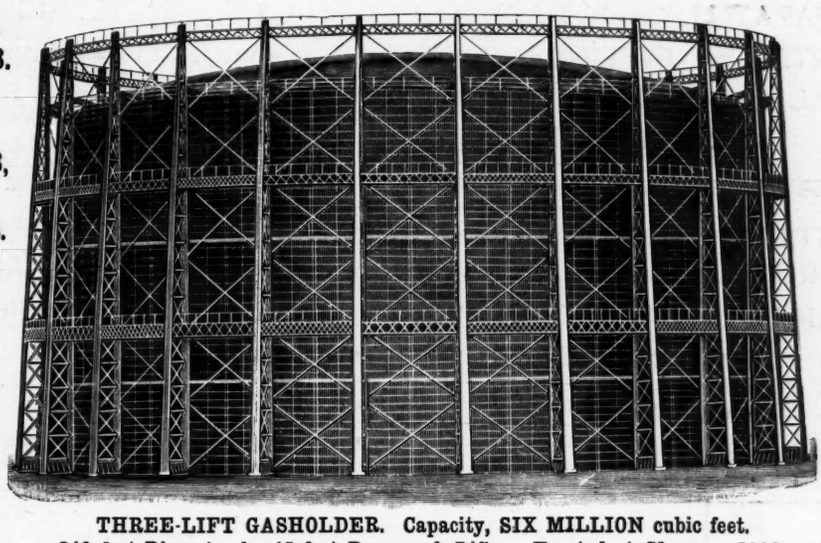

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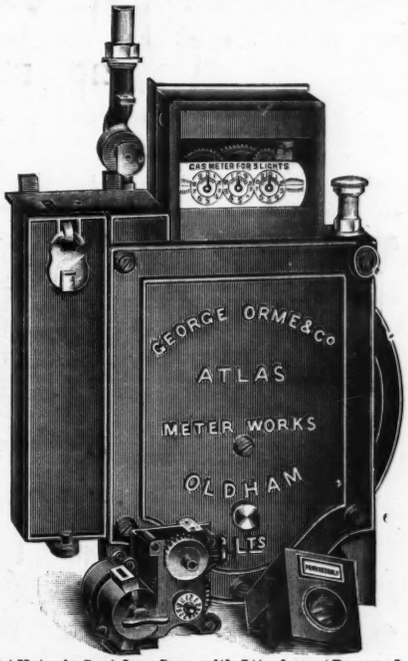

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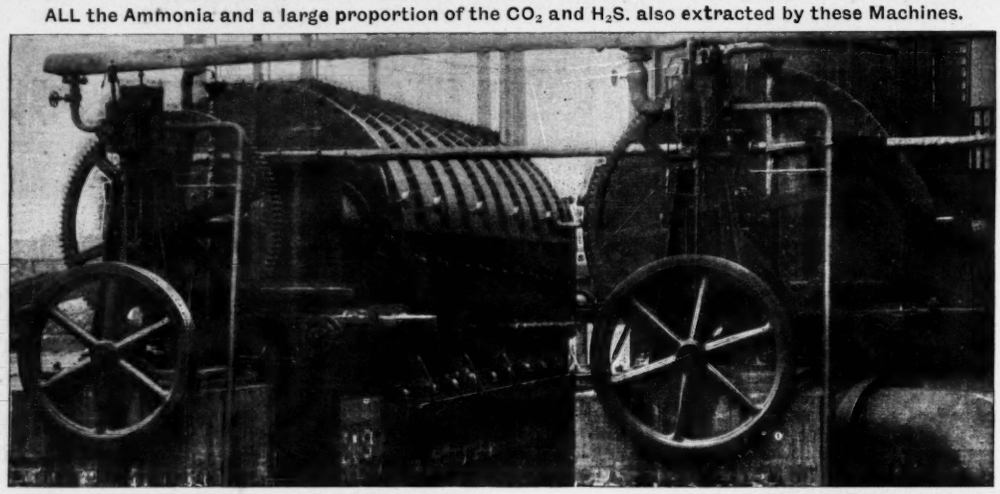

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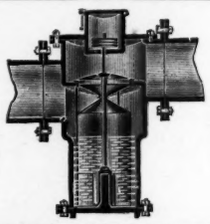

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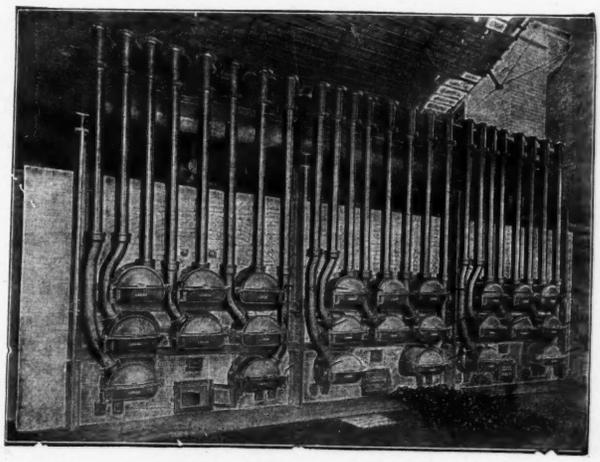

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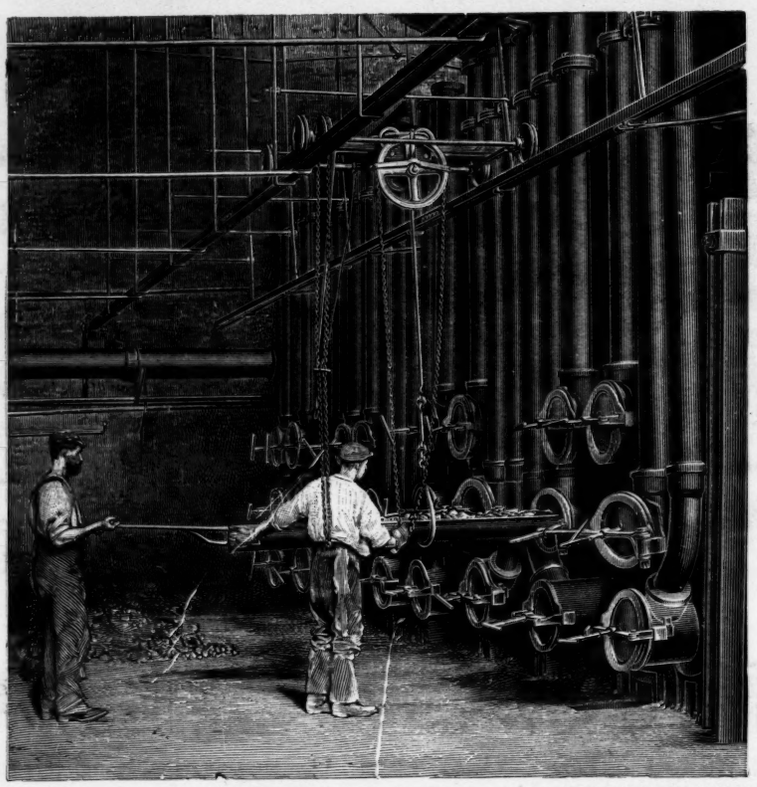

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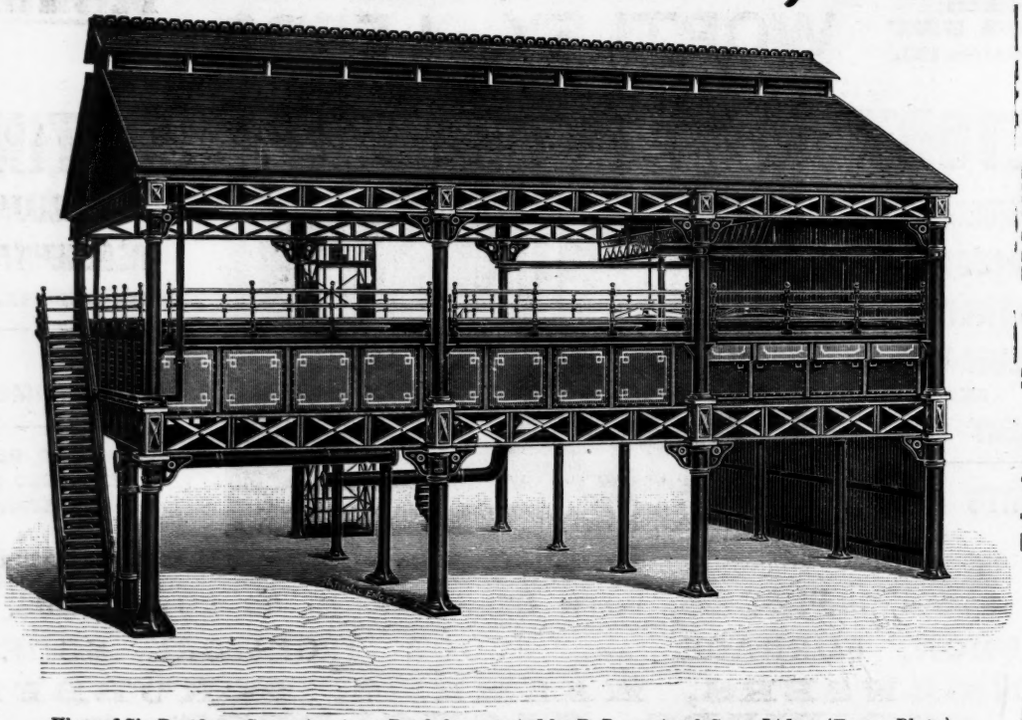

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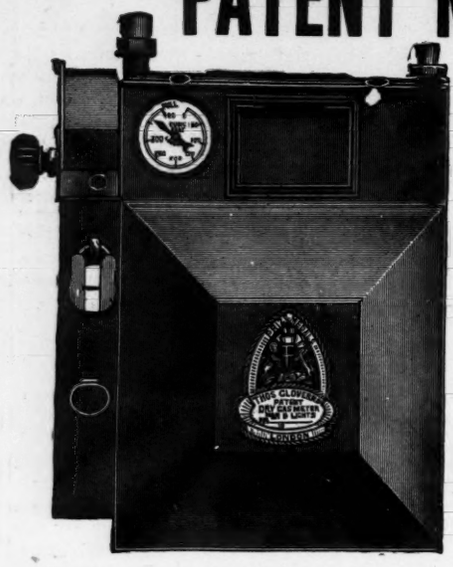

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

VOL. LXXVIII., No. 1998.——TUESDAY, AUGUST 27, 1901.

EDITORIAL NOTES.

A Barren Session.

THE Parliamentary Session that came to a close on Saturday week is noteworthy as being the first session of a new century and of a new reign. Beyond that, there is nothing to attach any distinction to it; for a more dreary, unfruitful, disappointing affair could scarcely be imagined. We have already referred to the utter want of business capacity displayed in the conduct of the affairs of our State; and the fact has become so patent as to call forth most candid criticism from the leading daily journal. In a review of the session, "The Times" remarked that Ministers, "as a "body, though there were one or two marked exceptions, "went about their work with a shiftlessness and slackness "that were discouraging." That the Government should have allowed a handful of obstructive bores to so fritter away the time of Parliament that in the end 67½ millions of money had to be voted without discussion, is a scandal that reflects seriously upon the business capabilities of our statesmen. It is as if the chairman of a board of gas directors or of a gas committee allowed all the time of the meetings to be wasted in idle discussions over some unimportant matters, so that no time was left to consider the contracts for coal. Yet the public make no sign of impatience—the buffooneries of certain of the Irish members attracting infinitely more attention.

The additions to the Statute Book have been few, and not of really first-rate importance; the most useful being the measure for amending and consolidating the Factory Acts. The provision of an adequate income for the Sovereign and his Consort was one of the most grateful tasks upon which the Commons were engaged; while the extension of the Royal style and titles to include the British dominions all the world over found very general approval. To call attention to the Education Act passed at the end of the session is but to emphasize the further failure of Lord Salisbury's Government to deal with this most important subject in a statesmanlike and adequate fashion. It has indeed been a stumbling-block in their way ever since 1896. The question is promised an early and honourable place in the programme for next year's work. We hope—though we can scarcely say we expect—that it will be dealt with in a comprehensive and common-sense manner; for there is a crying need for the institution of a coherent and rational system of education—primary, secondary, and technical—in this country. We want unlimited supplies of well-educated youths for employment in our industrial concerns, not the half-baked smatterers whose brains find delectable and satisfying food in the constant perusal of twaddle and snippets, supplied for a halfpenny per day and a penny per week respectively.

The main business of the session was financial. The provision of means for carrying on the war in South Africa, and for rendering more efficient our Navy and Army, resulted in a record Budget; and the public have to face a continued high rate of expenditure for some while to come. Indeed, if taxation is to be eventually reduced, very considerable economies will have to be effected in the future; for, apart altogether from war charges, the normal expenditure for the current year is estimated at upwards of £130,000,000, and the present rate of taxation is calculated to produce only about £143,000,000. There is, therefore, but a margin of £13,000,000 to meet the ever-growing demands for expenditure. "Old-Age Pensions" becomes a more than ever academic subject for discussion.

The additional taxation by which this enormous revenue is to be raised comprises a further 2d. on the income-tax, an import duty of 4s. 2d. per hundredweight on sugar, and 1s. a ton export duty on all but the cheapest classes of coal. The last proposal met with strenuous opposition in the House of Commons, but was not generally disapproved. The Chancellor piloted his Budget through Parliament with considerable skill, and without resort to closure—the one businesslike and satisfactory achievement of the session. He has recently expressed the hope that no addition to the income-tax will be necessary next year. We certainly hope that none will be made, even though additional taxation be necessary in view of the prolongation of operations in Africa. The worst of it is that this heavy expenditure in the next year or so will have to be met out of diminishing trade profits—the period of exceptional prosperity having undoubtedly passed away; and its departure will not be retarded, but rather hastened, by the reduced spending capacity of the taxpaying classes. There are, we fear, somewhat troublous times ahead, though no doubt arises as to our capacity to weather them as hitherto. But the need for business qualities is greater than ever in national as well as in industrial affairs.

Liverpool Gas Affairs.

THE annual meeting of the proprietors of the Liverpool United Gaslight Company has just been held, under the presidency of Sir Edward Lawrence, whose speech, as usual, gave an exhaustive account of the actual condition and prospects of this great undertaking—the largest in the United Kingdom, out of London, belonging to a Company. It is unnecessary to lay stress here on the strong principle of continuity which characterizes the policy of the Liverpool gas administration, and has not varied for many long years. The existence of this principle is quite compatible with the pursuance of a liberal and progressive ideal of management, as the high technical and industrial record of the Company abundantly proves. The utmost degree of open-mindedness in regard to the consideration and, if approved, acceptance of new methods of gas manufacture and popularization of the supply goes together with a not unpleasing steadfastness in trading in the ancient ways of carrying on the business. If anyone were to remark that the heads of the Company are a little old-fashioned in certain of their notions, it would doubtless be regarded as a compliment. At any rate, that new-fangled arrangement, the sliding-scale, never had any charms for the Liverpool Gas Company; and there is not the remotest chance now that it will ever be introduced into the city. The Directors always have believed firmly in so ordering their business as to earn the maximum dividends for their shareholders, while selling the highest quality and purest gas in the kingdom at the lowest possible price permitted by the working expenses of the concern. So exceedingly well has this broadly simple policy answered, that it is on record how the Corporation rejected the suggestion to municipalize the undertaking as extravagant and impolitic.

This being the Company's ancient case, special weight attaches to the admission of the Chairman at the recent meeting that they had not earned their dividend last year, and that the consumption of gas showed a decrease for the first time in the history of the undertaking. The actual figures are small, and Mr. William King, the Engineer, blames the mild winter for the falling off in the demand by the private consumers with ordinary meters. But the facts remain; and the Chairman holds that the advanced price of gas had more to do with them than the climate. The increase was only 3d. per 1000 cubic feet; and it was insufficient to compensate for dearer coal; but Sir E. Lawrence entertains no doubt that it checked the consumption. It is, moreover, for the present impossible to return to the old price; so that the adverse influence must continue to operate for an indefinite period. This is a matter for regret; because increased consumption means reduced cost of production. The competition of the Corporation electric light, of course, presses upon the Company; and this pressure, though not alarming, will tend to increase rather than diminish. The only possible means of meeting it is cheap gas—cheap, that is to say, in the estimation of the consumer, which is apt to disagree with the ideas of the manufacturer. The position is that the consumer thinks most of the price charged, while the manufacturer is bound to have regard to the quality of the supply.

It is undeniable that, from the consumers' point of view, Liverpool gas is high-priced. Comparisons are always being made in the newspapers and elsewhere between the prices of Liverpool and Manchester gas; and though, when

what the consumers in the two districts really get for their money is taken into account, the advantage is not with Manchester, this does not weigh with the public. The facts all show this to be the truth of the situation. The price is all that the public heed; and when this is increased by ever so small an amount, they resent it as an imposition. The question that naturally arises hereupon is why the Gas Company should continue to incur undeserved reproach by adhering to a standard of gas manufacture which their customers do not appreciate, and, in truth, do not really want. The day of 20-candle gas is past, and that of 14-candle gas is passing. Why sacrifice custom to an obsolete technicality of the trade? Sir E. Lawrence confesses that the inroads of fashionable electric light are being made good by "other means of using gas which are constantly coming "into operation." Is cannel gas needed for these? If so, it will be a bad outlook; because the same authority owns that cannel coal is the one raw material used by the Company which does not get cheaper. Oil is cheaper, truly; but probably the Chairman would say that the Company already make as much carburetted oil gas as is prudent. They do not want to rely too much upon this commodity. Do the consumers of Liverpool gas for cooking, heating, the production of motive power, and incandescent lighting, prefer carburetted water gas, at the price, for these uses? Certainly not. There is no reason why they should; and there is much against it. Therefore, taking all the official admissions and statements into consideration, there is only one conclusion to be drawn from them. If the customers of the Liverpool Gas Company do not care for their gas supply, at the price, the Company are not bound to go on trying to push it down their throats by Act of Parliament. The alternative is obvious.

The Delay in Testing the Validity of the Welsbach Patent of 1893.

THE whirl of journalistic life, and the efflux of time, occasionally rob the memory of matters which when first brought to notice do not, perhaps through the circumstances then prevailing, strike one as being of particular moment; and yet that same efflux of time which blots those matters from recollection may give to them a distinguished significance. For an illustration, we have only to refer to the Communicated Article which appears this week on the subject of the Welsbach 1893 patent, the most weighty part of which, from our point of view, is that which directs attention to a paper read by Mr. W. Mackean, F.C.S., before the Society of Chemical Industry on Feb. 16, 1891, on the subject of "Incandescent Gas Lighting." Mr. Mackean was then the Chemist of the Welsbach Company; and in his paper he supplied information which has, we must confess, a serious bearing upon the strength of the Company's patent which was applied for almost exactly two years subsequently—that is to say, on Jan. 3, 1893—and under which they are working to-day. Now that the matter has been recalled to mind, we well remember Mr. Mackean's communication; and the fact that it had been lost sight of was quite excusable. At the date the paper was read, the master-patent of the Company had not half spent itself; and therefore, as the Company practically controlled the market, the paper did not then possess the importance that it assumed when the 1893 patent was applied for, but by which time many of those who heard and read the former had forgotten its exact purport. The years which passed before the master-patent expired tended to further oblivionize the paper to all but those inside, and perhaps a few outside, the Company.

At this time of day, there is no necessity to explain to "JOURNAL" readers the connection which exists between "one and two per cent." of cerium and the 1893 patent; nor is there any need to inform them of the fact that "priority of publication" is sufficient to invalidate a patent. Nor, again, do they require to be reminded that actions have been commenced and are still pending (with little prospect, without some forcible incentive, of an immediate determination) which would, if fought out in the High Courts, once and for all settle the present unsatisfactory conditions surrounding the disputed validity of the patent. These actions being still in the balance, we are not going to be so injudicious as to commit ourselves to any statement which could be construed to our disadvantage. But we do intend, and that earnestly, to bring, now and hereafter, to public notice any and every fact which may be helpful in removing the existing unfortunate uncertainty, and ending the constant, but apparently (as things are at present) indeterminate, litigation, which, we regretfully say, has dropped almost to the level of guerilla warfare.

Mr. Mackean's paper, of a decade and more ago, supplies certain facts which readers may appraise as they choose. But be it remembered that these facts bear upon the all-important question of cerium in the composition of incandescent mantles, and that they were published about two years before the now celebrated 1893 patent was applied for. The author's first reference to cerium occurs in certain prescriptions which he named for making mantles giving light of varying colours; and in the compositions for yellow light, in one place he mentions 2 per cent. of cerium oxide, and in another 3 per cent. Then immediately afterwards he says: "Of the many substances which may be employed, cerium "oxide is the most satisfactory for the yellow lights when "added in small quantities." In giving the most effective composition in regard to the duration of light, he again mentions cerium oxide. When commenting on one of his tabular statements, he observes that it shows "the illuminat-"ing power remains more constant when 1 per cent. cerium "oxide is added to the fluid; but the colour of the light is "nearly red, and unsuitable for ordinary lighting purposes." Needless to say, the latter part of this sentence does not conform with the experience of to-day, nor even, it is safe to say, with the experience of two years after the paper was read, when the application was made for the 1893 patent. Turning, however, to the second table attached to the paper, it is found that it deals exclusively with tests showing the bearing upon the lighting power of mantles, per 100 hours up to 1000 hours, of different percentages of cerium. At the end of 1000 hours, the ordinary lighting fluid containing 0·25 per cent. of cerium oxide showed a percentage loss in light of 43·2. Raising the cerium oxide to 0·5 per cent. reduced the loss in light, in two sets of experiments, to 36·6 and 31·4 per cent. respectively; and—mark this!—when the cerium oxide was increased to 1 per cent., the percentage of loss was only 12·6 and 28. "One to two" per cent. (as already stated) is the quantity specified in the 1893 patent. With these published facts before us, there is no room for asserting that the benefits to be derived from 1 per cent. of cerium oxide were not known prior to the 1893 patent. Had the late Managing-Director of the Company the publication of this paper in mind when he said to shareholders at their last meeting: "Unless you can rely upon a patent monopoly, you must "place yourselves in a position of commercial supremacy"? In the paper competitors of the Welsbach Company have a powerful weapon both of offence and defence.

While on this subject, we feel that the time is opportune for protesting—and we do so most seriously and emphatically—against a system which permits users and small retailers of mantles other than the Welsbach (and some of them innocent of wrong-doing) being attacked, threatened, penalized, and even committed under a patent which has not obtained the seal of validity from the High Courts, while there are makers of mantles, with manufactories in this country, who are doing a substantial wholesale business, and who are within arm's-length of the Welsbach Company. These are the people who would be fair foes, and who are substantial enough, if the Welsbach Company chose to test this doubtful question to a conclusive issue. While these people are within reach, we fail to see a spark of righteousness in the present procedure, which we have none too harshly described as guerilla warfare. It is high time that an end was put to this sort of thing; and if the Welsbach Company will not move, then those who have their own interests to defend—such, for instance, as the owners of patents requiring mantles for their beneficial use (who at present complain to us of overbearing treatment on the part of the Welsbach Company)—should combine for the purpose of ascertaining whether they cannot, as is suggested elsewhere, move the Attorney-General "to "deal, or cause to be dealt with, once and for all, the "question of the validity of the 1893 Welsbach patent." For our own part, the only interests we have to serve are those of the gas industry generally and of the public; and we do not write as we have done on this and previous similar occasions in the cause of any of the manufacturers who are competing with the Welsbach Company. All we want—in the interests of the gas industry and the public—is a proper legal decision upon this matter; and then we shall be satisfied, whichever way it goes. In this connection, we do not forget the words of Sir Henry Burdett, at the last meeting of the Welsbach Company: "Although "the 1893 patent has been certified . . . no decision

"has yet been obtained in the Law Courts." When a decision has been obtained, if it is in favour of the Company, we will write just as ardently in the cause of the suppression of trafficking in infringements as we now do in seeking for a speedy judgment from the proper tribunal.

Mr. Westinghouse on Gas Power.

THE progress of the electrization of British railways will be watched with intense interest on the part of every order of the community. This movement is really the only radical alteration in the method of railway transport that has been seriously entertained since the first steam railway sprang complete, so to speak, from the brain of George Stephenson. How vast and far-reaching the proposed change is, would be brought home to many minds for the first time by the long letter of Mr. George Westinghouse to "The Times" of the 19th inst., in which he contends that the source of the motive power of British railways in the future will not be steam at all, but gas. Mr. Westinghouse declares that the ordinary railways can only be economically worked by electricity, with all that this change of method entails, if gas is made the prime mover of the dynamos; for the reason that steam power is three times more costly than gas power generated on the large scale required. This is a very bold assertion to make; and in considering it for a moment, it will be desirable, as the old sage used to say, for one to "discriminate." Of course, the man in the street, and his purveyors of information by means of the newspaper press, have long jumped to the conclusion that twopenny tubes and electric trams are bound to be the favourite means of rapid railway transport in the future; and that unless the ordinary steam railways are converted to the same manner of working, they will be deserted by the travelling public. There is some reason in this supposition, as the actual experience of the underground railways in London indicates; but the conclusion is by no means so obvious as it appears to be in the popular imagination.

In the first place, all the main lines of railway are already made along the most eligible routes, and competition for traffic cannot be easily imposed upon them, as it was in the case of the Metropolitan lines. Consequently, if these main lines are electrified, it can only be on the merits. Now, this is precisely where the weakness of electric traction systems shows itself. It is very alluring, in popular estimation; so that of two lines catering for the same public, one steam and the other electric, the latter would receive the most custom and earn most money. This would cause it to pay better. Whether it would be economically superior to the other is another question, which mere popularity does not touch. Take, for example, the Central London Railway —the typical "twopenny tube." With all its advantages of uniformity of working, and a track made with gradients to order, the running expenses last half year were 54 per cent. of the total receipts. This was not so vastly superior to the showing of an ordinary steam railroad as to warrant the extravagant hopes of some strong partisans of electric traction as a panacea for poor railway business.

Mr. Westinghouse sees this weak place in the argument for electric traction, and states that it is due to the costliness of steam power. He asserts it to be a fact that scarcely one of the great electric power stations heretofore built and operated is satisfactory to its owners in respect of cost of operation and other particulars. Not being a philanthropist in business, he says roundly that in the struggle for development of the different industrial applications of electricity, all the various interests concerned have looked after themselves. Every system has its advocates, because all have their own specialities to sell. He himself is a manufacturer of gas-engines, in which he believes. Inasmuch as the first cost of power plant is of less importance than the continued cost of operation, he declares that the saving to be effected by the use of large gas-engines supplied with cheap producer gas will equal an amount which will represent the interest on about twice the estimated cost of a given power station of the modern type. It is, he asserts, only by means of a much cheaper method of generating electricity than by the use of steam-engines of even the best type, that one can hope to effect such economies as will justify the great railways in operating all their suburban trains by electricity. The decreased cost of production of electricity by means of gas-engines, as compared with the present steam-engine plants, would enable the unit "to be sold at so low a figure "as to justify a wide use of the electric current for cooking "and heating purposes."

This consummation would be very much like "seething "the kid in its mother's milk," having regard to the circumstance that without the ordinary gas industry there would have been no gas-engines at all, whether for generating electricity or anything else. And now Mr. Westinghouse has the brutality to suggest that the gas-engine—his own make, of course—is to rob the poor gas companies of the last occupation that, in thought at least, ambitious electricians have hitherto left to them! This is too sad. Fortunately, we have the satisfaction of reflecting that, after all, it is only a prophetic utterance to which Mr. Westinghouse has treated an expectant world; and we have heard a good deal of unfulfilled prophecy from similar sources. If Mr. Westinghouse had only left the gas industry alone, we would have willingly left him alone with his prospects of driving all the suburban trains by (Westinghouse) gas power. But since he has not confined himself to this extensive province, we make bold to remark that he had better take to heart the advice of Wolsey to Cromwell. We simply do not believe that the first stage in his projected triumphal progress is a sure one. The big gas-engine is a very fine thing; and doubtless Mr. Westinghouse would like to see it selling more freely than it has hitherto done. But the question of the cost of power so generated is not a simple matter of fuel consumption. There is the ground space required, to name only one consideration. Then there is the question of nuisance. Before Mr. Westinghouse's prophecy can be taken seriously, will he demonstrate the superior advantage in every respect of a gas-power plant established (say) on a five-acre plot of land upon the Regent's Canal, in comparison with a parallel case of steam-power plant? When these particulars are available, a critic may possibly be able to carry still farther the operation of discriminating.

The Wages Question in the Coalfields.

THE events of the past week, so far as they go, do not point to danger of any immediate labour troubles in the coalfields, though the clouds still hang overhead. The trade in Cumberland has been disturbed for some while past over the wages question; the owners claiming a reduction of 25—afterwards modified to 10—per cent. The representatives of the miners on the Conciliation Board that has for some years regulated wages in Cumberland referred the proposal to the men. The latter not merely declined to agree to the reduction, but voted against the question being determined either by the Conciliation Board or by arbitration—a line of action calculated to bring the existence of the Board to an end. It is now, however, reported that the masters have, for the time being, withdrawn their claim for a reduction in wages; so that a crisis is for the present averted. But the spirit of the men does not promise well for the time when the question is, as it will certainly be, reopened.

A much more reasonable spirit appears to be animating the counsels of the Scottish miners, whose decision upon the question of the proposed further reduction to which we referred last week, was made known last Wednesday. The decision was to the effect that, while declining to agree to the reduction (from 6s. 6d. to 6s. per day), the men were willing to leave the matter in the hands of a neutral chairman, and abide by his decision. So far good; but the question now is whether the representatives of the owners on the Conciliation Board will consent to the suggested settlement by a neutral chairman. Some of the owners of inferior quality coals declare that they are losing money at present prices and rates of wages, and that they must obtain relief in respect of the second item if they are to continue working. The matter has now been referred to individual owners for their decision; and it remains to be seen whether the men's proposal of a neutral chairman will be accepted. It appears a reasonable one.

In Wales, the question of whether the export tax should be included by the Accountants to the Sliding-Scale Committee in determining the average selling price of coal, still remains unsettled. The men are raising the further point as to whether the action of the owners in opening the sealed memorandum of the Accountants, showing the data upon which their report was founded, does not constitute a breach of the terms of the sliding-scale agreement sufficiently serious to enable the men to repudiate the agreement. Should this prove to be the case, the Federation leaders talk of at once terminating the agreement (which has more than another year to run), with the idea of instituting maximum and minimum rates of wages governed by a Conciliation Board —the system in vogue in other Federation districts. They

think that they could obtain better terms now than when the agreement will expire naturally. Probably the owners would not altogether see eye to eye with "Mabon" and Company should the improbable happen, and the agreement be terminated shortly. But we do not anticipate immediate trouble in the Federation districts. It is all to the good that Messrs. B. Pickard, M.P., "Mabon," M.P., and other of the well-known Union leaders, are going shortly to America, in order to study labour conditions in the States.

Meanwhile, the unsettled condition of the wages question is materially affecting the output. The men in many districts are not working more than three days a week for fear of "slumping" the market. In reference to this point, an interesting diagram was recently published in the "Newcastle "Chronicle," showing the relationship of output to wages during the past 21 years. From this it is strikingly evident that the tons worked per man per day decrease as the rate of wages increases. In 1900, with wages at the highest point—145, or 45 per cent. above the standard—the output fell to the lowest, being 1·061 tons per man per day. With wages at 88, the output stood at 1·415 tons. This only confirms us in the view that when wages have got down all round, the output will increase and prices fall lower.

Science in Glasgow.

If Glasgow does not flourish exceedingly during the ensuing years, it will not be for want of the light of science, which is being shed over the banks of the Clyde this season with a profusion that was only exampled in the experience of Paris last year. What lasting benefit has accrued to the French capital from the numerous and crowded congresses of scientific and learned persons that constituted so striking and important a feature of the great Exhibition, is yet a doubtful quantity; but, whatever it is, Glasgow is apparently determined to be a good second in the new struggle after the fruits of orthodox philosophy. Not to say anything more for the present about the general Engineering Conference, in which the section devoted to Gas Manufacture will be so honourably prominent, we cannot defer mention of the meeting of the British Association for the Advancement of Science, which is to open on the 11th prox., under the presidency of Professor Rücker, the Principal of the University of London and the Secretary of the Royal Society. Sixty years ago the Association met for the first time in Glasgow, with the Marquis of Breadalbane in the chair. In those far-away days, the cultivation of exact knowledge was not esteemed as of such paramount importance to the community as it is now the fashion to hold in the highest ranks; and it required the patronage of some ornamental personage in order to lend prestige to the annual meetings of the Association. Two subsequent gatherings in Glasgow were presided over by the Duke of Argyll and Professor T. Andrews, of Belfast; and these names plainly illustrate the character of the change that has come over the public work of the organization. The same observation applies to the character of the presidential address. His Lordship of Breadalbane gave none. It was not expected of a person of his quality. Both the Duke of Argyll and Professor Andrews were warily retrospective, and dealt with the progress made in general science in their day. As a consequence, their elegant compositions were more interesting at the time than permanently instructive. It is expected that Professor Rücker's address will be instinct with the modern spirit; and that the eminent Principal, who has devoted a great deal of time and attention to questions relating to the action of molecular forces, will make use of his opportunity for announcing the conclusions in regard to the atomic theory, and the mechanical theory of heat, to which his own investigations have led him. This would be decidedly more satisfactory than any exercise in mere criticism. A further concession to modern notions respecting the proper office of a congress of men of science who of necessity do not often foregather in the flesh, will be the holding of several arranged discussions on topics of particular interest at the present time. "Journal" readers will most probably take most interest in the proceedings of the Section of Economic Science and Statistics, over which Sir Robert Giffen is to preside. Besides the President's Address, which is sure to be excellent, several papers dealing with points of municipal trading are promised for this section. There does not appear to be anything specially relating to gas supply in the Engineering Section, which has noticeably suffered from the competition of the engineers' own conference. The new Section of Education, with Sir John Gorst as President, ought to evoke some notable contributions to the literature of the subject.

WATER AFFAIRS.

Some Fruits of the Past Session.

While the opening session of the first Parliament of King Edward the Seventh cannot be said to have been productive of anything very striking in the way of water legislation, it was not by any means devoid of interesting features, as our columns bore witness during the progress of some of the Bills. As far as the Metropolis is concerned, the attempt of the London County Council to obtain parliamentary sanction to acquire the undertakings of the London Water Companies by agreement or arbitration, was frustrated early in the session by the defeat of their Bill at the second reading stage. As the last General Election had deprived the Council of their doughty representative in the House of Commons—Professor Stuart—their cause had to be championed by Mr. John Burns. But the forcible language which is characteristic of the honourable member for Battersea failed to convince the House, though he was supported by Sir William Harcourt and Mr. Asquith, that the Council should be entrusted with the powers they sought; and their Bill was rejected by a majority of 77. It is difficult to see what other conclusion could have been come to, in face of the deliberate promise made on behalf of the Government that the London Water Question would be dealt with by them, although Sir William Harcourt attempted to shake confidence in its sincerity. Mr. Long, the President of the Local Government Board, however, reiterated in the most unequivocal language his intention of framing a measure which he hoped would finally settle this vexed question; and this assurance had due weight with the House. Their defeat was a sore rebuff to the authorities at Spring Gardens. But they had their revenge later on; for they succeeded in passing a Bill to extend the provisions of the Staines Reservoirs Acts of 1896 and 1898, so as to continue till 1906 the operation of what has come to be generally known as the "sterilization" clause. Just as the session was drawing to its close, and when the London Water Question had been forgotten, Sir Blundell Maple sprang upon the House a notice of his intention to introduce a Bill dealing with it. He carried this intention into effect on the 23rd ult., and his Bill was read the first time. But its promoter moved for its reference to the Examiners, whose report, upon which the second reading depended, had not been presented when Parliament was prorogued. Here the question will in all probability rest until its revival by the presentation of Mr. Long's scheme for its settlement.

Outside the Metropolis, one of the noteworthy features of the water legislation of the session was the encouragement given by Parliament to projects for the formation of Joint Water Boards. One was sanctioned for Aspatria and Holme Cultram, in Cumberland; another for Ilkeston and Heanor; a third for Southport and district; and a fourth for Biggleswade. The first project was unopposed; but the second was less fortunate, as three Local Authorities and certain millowners alleged that they would be prejudicially affected by the scheme. An interesting point raised in connection with this matter, to which attention was called in our columns at the time the Bill was before a Committee, was as to whether the water proposed to be taken was "underground water" according to *Chasemoor v. Richards*, or "water flowing in a defined channel." The decision of the Committee was in favour of the latter definition. The projects emanating from the Southport district and from Biggleswade, like the Cumberland scheme, did not encounter opposition. Purchases of local water-works were authorized in the cases of Broadstairs, Llandrindod Wells, Prestatyn, and Wells; but the Corporations of the two Hartlepools failed to satisfy the Select Committee who considered their proposal to acquire the undertaking of the Hartlepool Gas and Water Company that there was the smallest justification for making it. Extensions of works of some importance were authorized in several cases, the scheme of the greatest magnitude being that of the Leeds Corporation, which, however, was somewhat curtailed during its progress through Parliament. The Stockport Corporation obtained parliamentary sanction to carry out their important Kinder scheme. The South Essex Water Company, after two failures, were at length successful in enlarging their area; but the Rickmansworth and Uxbridge Valley Company and the Wolverhampton Corporation failed to obtain authority for doing so. In the two latter cases, the

question of the conservation of water areas was raised on the motions for the second reading of the Bills; and as the promoters' schemes encountered determined opposition from the parties affected, the measures embodying them were not allowed to go forward. The proceedings were not, however, barren of fruit; for one of the opponents of the Wolverhampton Bill was instrumental in getting a new Standing Order framed, giving *locus standi* before the Lower House to parties prejudicially affected by the abstraction of underground water.

A few interesting incidents of the session may be recalled in closing this review. First in point of importance stands a question of principle raised in connection with the Leeds Corporation Water Bill. It may be remembered that *locus standi* against the Bill had been refused by a Committee of the Lords to the West Riding Rivers Board, on the ground that these bodies did not come within the terms of the Standing Order granting powers of opposition to County Councils. The Earl of Crewe, who took up the matter on behalf of the Board, not only had to contend against the Chairman of the Committee who considered the Bill, but also against Lord Morley. This combination of forces was too strong for him; and so the Bill went down in safety to the Lower House. There, however, it encountered opposition from practically the same body which had been denied *locus* in the Lords; for the West Riding County Council—the new opponents—are very largely represented on the Rivers Board, and it was on this account that they claimed the right to be heard. However, the tactics of this somewhat meddlesome body were too apparent to the Commons Committee, who not only would not allow the Council to appear, but ordered them to pay costs—a fact which they will have the satisfaction of knowing has been duly recorded in the official list of proceedings on Private Bills. The lesson should prove a salutary one. Another incident of the session was the granting to the Tees Water Board, in the face of considerable opposition, of power to sell surplus water in bulk to the Local Authorities of the district and others. Seeing that they will soon have a margin of close upon 100 million gallons, to have been compelled to withhold it from their neighbours would have been little short of wickedness. It is not often that sentiment makes an impression on a Select Committee of the House of Commons; but it did so in the case of the Derwent Valley Water Board Bill, which was shorn of a valuable feature, in the shape of a railway, as a concession to clamour raised in Sheffield against a so-called desecration of a natural beauty-spot. These are some of the salient features of the water legislation of the session. The details of the various measures which have been placed upon the Statute Book must be left for notice in the usual articles dealing with them.

Empty Reservoirs and Restricted Water Supplies.

THE spell of dry and bright weather which has prevailed since the severe thunderstorm of last month, while being a source of gratification to holiday makers, is intensifying the anxiety of those who are responsible for keeping up a supply of water. In many parts of the country the reservoirs are very low—so low, in fact, that in one case the opportunity is being taken for repairing portions of the wall which are generally covered. With the surface of water from 12 to 18 feet down, as it is at Heywood and Rochdale, it can scarcely be wondered at that the strictest economy in the use of the available supply should be enjoined. Manchester, notwithstanding that it has a feeder in Thirlmere, is feeling the drought acutely. We learn from a picturesque account of a recent visit to the Longdendale Valley, by a writer in the "Manchester Guardian," that two of the Corporation reservoirs there contain only about one-tenth of the water which should now be in them; and what there is is in one case too thick to run. But the worst is still to tell. The Woodhead reservoir—the second in point of capacity, being capable of storing 1180 million gallons of water—is absolutely empty. The Vale House reservoir is so depleted that the foundations of the old hamlet which its waters submerged are distinctly seen, including the spot where forty years ago stood the gasholder from which it derived its source of light. At the time of the visit, "sheep were grazing among the "tumbled stones of an early nineteenth century mansion, "among the remaining pools of an up-to-date reservoir;" and springs which had recently yielded 13 million gallons of water daily had run dry. Fortunately, the water stored in these reservoirs is used for compensation purposes; but the fact does not at all minimize the seriousness of their condition as affecting the general supply of the city. The water in store at Longdendale is now equal to a full supply for about 36 days. The restriction already imposed by the Water Committee effects a saving of 5 million gallons a day; but as the consumption last Wednesday was only 3 millions less than the normal, further curtailment may be necessary. Manchester's neighbour—Stockport—is worse off, having but 23 days' supply; and the water is on for only eight hours a day. As both of these towns enjoy the so-called advantages of a municipal water supply, we, in London, who are dependent upon private enterprise, in the shape of eight "grasping and tyrannical" Water Companies, may well congratulate ourselves that we have not yet been called upon to submit to similar restrictive measures. That they were rendered necessary by unusual meteorological conditions would be held by the advocates of Municipalism to be no justification for their imposition in the Metropolis, or in any town served by a company.

ESSAYS AND REVIEWS.

MR. W. H. LEVER ON PROFIT-SHARING.

IT may be remembered that last January* we commented upon the views concerning profit-sharing set forth by Mr. W. H. Lever in the "Economic Review" (Rivington's) for that month. With those views we found ourselves in disagreement, partly because the alternative suggested (which is designated prosperity-sharing) appeared much less calculated to produce the desired end than profit-sharing, and partly because of Mr. Lever's tenderness for Trade Unions and his idea that their hostility to profit-sharing is an acceptable argument against its adoption. Mr. Lever's plan for securing the display of greater zeal and industry by employees is, briefly, that of setting aside each year a certain share of the profits of a business (that share to be determined by the employer) for the collective as distinct from the individual benefit of the employees; the money so set aside to be spent in the building of houses, clubs, and other social institutions, in subsidizing provident societies, in providing holidays and entertainments, and so on—the allocation of the money to be at the discretion of the employer, and the amount spent each year to be an average, and not to vary with the condition of trade.

This, as we said at the time, appears to be as futile a method in which to set about the task to be accomplished—namely, the creation of exceptionally efficient and zealous servants—as could be devised. Other critics have since had their say in the matter (see the April number of the "Economic Review"); and we fully agree with the opinion expressed by Messrs. Williams and Vivian, that Mr. Lever's plan would tend to "condemn the great majority of our industrial classes to a state of perpetual childhood, in so far as their working days are concerned, during which they would be subject to a supreme, though perhaps a benevolent, despotism." This criticism, and a remark from Mr. J. Bonar that "Mr. Livesey's important experiment in the South Metropolitan Gas-Works" shows "the direction in which profit-sharing must move if it is to be freed from the defects of its qualities," have drawn a rejoinder from Mr. Lever, published in the "Economic Review" for July.

In that rejoinder, Mr. Lever clearly shows the fallacies upon which his "prosperity-sharing" idea is founded. We have already referred to his eagerness not to interefere with Trade Unionism—the importance attached by him to the fact that they oppose the adoption of profit-sharing systems. That is one fallacy. The other is contained in his statement that prosperity-sharing "aims to treat the employee as on the average the equal of the employer in ability, tact, judgment, and business qualities." Was ever such nonsense heard? The average soapmaker the equal of Mr. Lever in those qualifications? The average stoker the equal of Mr. Livesey in ability, tact, judgment, and business qualities? The thing is too absurd. Yet Mr. Lever keeps harping on it: "The fact is, that all these schemes of labour co-partnership seem to take it for granted that the employee has to be taken care of like a child, and that he has not got the average amount of business acumen, insight, and foresight. But, on the contrary, he does possess those qualities; and hence he makes no rush to put his money into the schemes, as he certainly would if he saw in them substantial advantages with little risk of losing his capital." Again we must say, what nonsense!

What has Mr. Lever to answer to this? In 1894 the Directors of the South Metropolitan Gas Company amended their scheme so as to afford opportunities to their men of voluntarily investing their bonuses in the Company's stock. The *best* of the men availed themselves of these opportunities; the least efficient (speaking generally) did not. Now no one who knows anything would deny that substantial advantages (attended by practically no risk of losing the capital) are to be obtained by investing in the South Metropolitan undertaking. Yet Mr. Lever would have us believe that those men who preferred taking their bonuses in cash (which often meant spending them in the public-house or

* See "JOURNAL," Vol. LXXVII., p. 260.

the music-hall) to investing them in the Company's stock, did so because they possessed "business acumen, insight, and foresight!" If so, what of those who chose to invest their money, and who are spoken of by Mr. Livesey as the "thrifty, thoughtful, and industrious men." Are we to be told that they lack the "business acumen," "ability," "judgment," and so forth displayed in such abundant measure by their fellows?

The "proof" that Mr. Lever advances in support of his curious notionthat employees are "equal in intelligence to the employer," is that "the ranks of the employers are constantly being recruited from the ranks of the employees. In fact," he says, "the men who to-day are the largest and most successful employers in England and America were, in the great majority of cases, employees thirty or forty years ago." Granting, for the sake of argument, that such be the case—we do not as a matter of fact admit the "great majority"—we cannot see that we are a hair's breadth nearer to proof that the average workman is the equal in ability, judgment, &c., to the average employer. Otherwise, it would be equally true that the average member of Parliament is equal in ability to Lord Salisbury, the average barrister to the Lord Chancellor, the average private to General Macdonald, or the average officer to Lord Roberts.

If Mr. Lever wants a new manager, does he put the names of a score of his workmen into a hat and draw? Moreover, we would ask, if the workmen be so obviously the equal in capacity of the employer, why is the entire control of "the share of profits belonging to labour" kept in the hands of the employer under "prosperity-sharing" schemes? Of course, we are not arguing that there are not many able, intelligent men among the rank and file of the industrial army. Fortunately, the reverse is the case. But to go about the designing of a system of prosperity—or profit—sharing upon the assumption that every jack is as good a business man as his master appears to us the height of folly.

Mr. Lever can see no virtue in the South Metropolitan profit-sharing scheme, and pours scorn upon it and upon the critics of his original article who pointed to that scheme as an example to be followed. He asks:

> Are these gentlemen aware of the contract which the employees of the South Metropolitan Gas Company are called upon to sign before they can become eligible to receive a share of the profits? Under this contract the employee surrenders his freedom of action, and, in addition, he cannot do what he likes with his share of the profits. The Company dictate to him how much of it he may draw out and spend, and how much they will force him to save. All this appears to me to represent what would be in reality "a state of perpetual childhood." Would any shareholder in an industrial or commercial company submit to dictation as to how much or how little of his dividends he should draw out? Such a method is far from treating the employees as if they were equal in intelligence to the employer; and I fail to understand what good or elevating effect such systems of profit-sharing can have, or how it can be said that by moving in this direction profit-sharing is to be freed from its defects.

None are so blind, they say, as those who will not see; and does not Mr. Lever remind us that "it is now over ten years since he ventured in a public speech, to call in question the success of profit-sharing"? The memory of his speech has, we fancy, given a bias to Mr. Lever's mind, which prevents him from recognizing the force of some undoubted facts, and causes his failure to understand what is patent to other students of the subject. Let us examine the passage we have quoted from his article relative to the South Metropolitan scheme—a scheme the success of which is admitted by everybody except Mr. Lever and the Trade Unions.

First, there is that terrible contract (the terms of which are probably familiar to Mr. Lever's critics, seeing that it is published in full in the Board of Trade Report on Profit-Sharing; Appendix D); how the enslaved employee must detest the agreement which makes him liable to remain in his present employment for twelve months! Yet what do we learn? Speaking at Newcastle on the 14th of October, 1889,* Mr. Livesey said: "These agreements have been objected to, *but never by the men*, who greatly value them, because they assure twelve months constant work. But they are not indispensable to profit-sharing. The late Mr. Mundella once said to me: 'I like your profit-sharing system; but I do not like your agreements. Are they necessary?' I called the eighteen workmen's representatives of the Profit-Sharing Committee together, and put the matter to them. They were absolutely and earnestly unanimous in urging that the agreements should not be abolished; stating that any alteration would 'greatly upset the men.' I reported this to Mr. Mundella, who replied that he was quite satisfied."

That is to say, the South Metropolitan workmen have no more objection to entering into agreements to serve for a year at a guaranteed wage, with the prospect of a substantial bonus, than has an engineer or a manager to binding himself for a much longer term. If, indeed, we would ask Mr. Lever, the average workmen is equal to the average employer in business acumen, insight, foresight, judgment, intelligence, and ability, is it likely that he will sign away his "freedom of action" for a mess of pottage? We presume that Mr. Lever does not suggest that under no conditions should an employee surrender any degree of his freedom of action. Or does he mean that *freedom to strike* is the priceless possession of the working man, which he, and he alone, should never surrender no matter how valuable the consideration offered?

* See "JOURNAL," Vol. LXXIV, p. 946.

Then there is the restriction as to the withdrawal of bonuses. "Would any shareholder submit to dictation as to how much or how little of his dividends he should draw out?" What on earth has that got to do with the question? The shareholder puts capital into the concern, and the dividends thereon, when declared, are his absolute property, over which the Company have no control whatever; and those dividends will continue to accrue to him so long as his capital remains invested in the business and profits are earned. Profit-sharing bonuses are payable under agreements voluntarily entered into by the employer for no consideration other than the implied undertaking on the part of the employee to do his utmost for the prosperity of the business, and terminable at the will of the employer. There is therefore no parallel between a shareholder's dividend and an employee's bonus, and no reason whatever why an employer should not, if he deem it best in the interests of himself and his men, make it a condition of his granting a share in the profits that all or some of the profits so allocated should be invested in the undertaking.

Mr. Lever says: "Such a method is far from treating employees as if they were equal in intelligence to the employer." But, under his "prosperity-sharing" plan, the Company would not merely "dictate to the men how much of their share of the profits they might draw out and spend, and how much they would force them to save." The Company would say: "We will spend it all for you. You shall not touch a penny piece. We will build houses for you, institute clubs, and give holidays and concerts. But, although you are equal in intelligence to your employers, and equally capable of spending the money wisely, you will not be allowed to so much as handle it, or have a voice in its expenditure." That is how Mr. Lever would deal with "the share of profits *belonging* to labour!"

"But why," it is asked, "should the workman be urged to invest his savings in the factory in which he is employed? Why should he not enjoy the liberty of working where he will receive the most money for his services, and of investing his savings where they will yield him the largest return in interest combined with security? This may not be in the same works—nay, *in all probability it will not be*." On what grounds the italicized statement is made it is difficult to tell, unless it be that Mr. Lever is so hopelessly prejudiced against profit-sharing that he thinks any business adopting it is *ipso facto* doomed to failure. As to his two questions, the first hardly needs answering. But for Mr. Lever's information, we would just remark that the man whose savings or part of them are invested in the factory in which he is engaged, is more likely to be a valuable servant than one who has no direct, obvious, and personal interest in its prosperity; while he is also elevated and stimulated by the knowledge that he is to some extent working for himself. It is a distinct advantage to a man to work in other than an indifferent spirit. In regard to the second question, any man is free to leave the service of the South Metropolitan Gas Company, as distinct from going on strike, and to go to work "where he will receive the most money for his services"—only their workmen know perfectly well that they receive full current rates of pay, *exclusive of the bonus*, and so vastly prefer to remain where they are; while, if Mr. Lever had ascertained all the facts of the case, he would have known that no objection is raised to a man investing the withdrawable half of his bonus elsewhere—in a building society, the savings bank, or any other security. All the Company ask is that he should not squander it.

We have dealt somewhat fully with Mr. Lever's objections, because the question is very much in the air at the present moment, and because some of the objections are frequently raised by those ignorant of or unduly prejudiced on the subject.

EVOLUTION: OLD LAMPS AND NEW FOR RAILWAY STATION LIGHTING.

MOST of us have had—some may have now—dear old friends who can remember the stage-coach days of England; and there are many among us who can call to mind the early days of railways in this country. These old friends, who always seem to find delight in turning their thoughts backwards, are frequently, especially when in the company of their juniors, given to discoursing upon the wonders of their days in the way of improvement; and, among their instances, they cite the present systems of rapid locomotion, which they are fond of describing as "luxurious." But after all, the great improvement which has taken place, not only in the means of travelling, but in all the necessaries and material things of life, is only what the intelligent man looks for. Growth is the natural law of life; and the evolution of means whereby greater comfort is constantly being secured to the human creature, and greater aid is given him in the execution and refinement of his everyday work, is but the natural outcome of that growth which is daily going on in the world's already vast and mighty intellect. Looking backward, and then taking stock of where we stand to-day, it is safe to say that there will be no halting or inversion in the world's progression. When we look at things as they were so far back as our memory will take us, and as our fathers tell us things were in their youth, the change which we see to-day (which has come about in such gradation as to have been almost imperceptible) will, while we regard it, appear astounding. But what of the

future? The machinery of to-day's life having been evolved from the comparative barrenness of a hundred or so years ago, what will the great fertility which we see around us—the knowledge of to-day superposed on the knowledge of a century ago—produce in the future? Take our gas, our electricity, our railways, and almost anything else, and look at their developments in the past, and then we may well ask—though it will be in vain—what are their inherent possibilities? It makes one almost smile to think upon the question of where in a few decades the world will be, in only the three respects instanced, if the same ratio of improvement continues. If we could only peer into the distance, we might be staggered; but, as we cannot, we must be content with the observation of things as they are to-day.

The itinerant whose duties call him hither and thither, is often given to musings on his long journeys; and the thoughts already penned were raised, while travelling, by a very simple matter—that was, the great variation existing on a railway in the lighting of the stations. Far away in the country there were primitive oil-lamps, which, in a few cases, cannot perhaps be avoided. At other stations were some examples—good and indifferent—of flat-flame lighting. Again, other stations made a display of incandescent gas lighting; and at the great terminus was seen high-pressure incandescent gas-lights and electric arc lighting. Such manifold lighting may be seen almost any night on any of our great railway lines. But while the writer mused on the evolution of artificial lighting from the time when the oil-lamp was the common means of illumination to the present, the question naturally arose, why are our railway companies so dilatory in making a general adoption of the best of the systems of lighting at their command? Constant improvements are being made in the rolling stock of the principal companies; and the convenience and comfort of passengers in the carriages themselves are studied to an almost superlative degree. And yet these self-same companies, with an exception, show a peculiar tardiness in making a general adoption of a system of lighting which experience in isolated places has shown them to be of the best in the points of economy and efficiency, and which affords gratification to their passengers. It is in the winter that artificial light is required, on many days, for at least two-thirds of the twenty-four hours; and it is in the winter that railway travelling is the most dreary and wearisome to those who have to move from one part of the country to another. And therefore it follows that railway companies should do their utmost to make travelling as genial as possible during the most uncongenial months of the year; and one ready way in which they can do this is by giving greater attention to the lighting of their stations. Waiting for trains at a station is not at any time a pleasant manner of occupying one's time; but on a winter's night the scene is rendered more animated and cheerful, and the traveller is correspondingly enlivened, by well-lighted platforms and waiting-rooms.

As remarked, the singular thing is that most of the companies have themselves proved what can be done in the matter of incandescent gas lighting; and yet its adoption by them, with perhaps the exception of the Midland Company, has been very slow. As we shall be able to show, the destruction of mantles is not so great as one would imagine would be the case where there is so much vibration as is necessarily occasioned where heavy trains are passing to and fro, where trains are constantly stopping and re-starting, where shunting is frequently in progress, where heavy laden trolleys are passing and re-passing, and where luggage is ever and anon being dropped in close proximity to the lamps. Therefore the question of maintenance is not a bar to adoption. Another case will show that the saving in gas consumption more than counterbalances the principal and interest on the cost of installation; and therefore the improved lighting, the increased cheerfulness of the stations, the lessening of the liability to accident, and the enhancing of the pleasure of travellers may all be taken as gains obtained without price. In this direction, then, it is not too much to hope for, and indeed expect, a great development to bring all our railway stations in line with modern progress in this important respect. The quantity of light which satisfied our forefathers will not suffice to-day.

We do not know of a single railway of importance that has not had experience of Welsbach incandescent gas lighting at their stations. In the forefront must be placed the Midland Company; and after them we are not sure of the order in which the Companies should come in the extent of the adoption of incandescent gas-burners. The Great Northern, however, has had considerable experience; and the London and South-Western Company have found its advantages in a manner which has carried conviction, and has led to an intention to gradually instal the system. The London, Brighton, and South Coast Company, although, we believe, they only started incandescent lighting in 1900, are so far assured of its merits that there has been talk of a considerable extension over the line. Other Companies who have installations are the London and North-Western, the Great Eastern, the Great Western, the South-Eastern and the Chatham and Dover, the London, Tilbury, and Southend Railway, the District Railway, and at least one Scotch line (there may be others) has had it under trial. It would take up too much time and space to collect and publish all the names of stations where incandescent gas lighting has found a home and won approbation; but we may usefully give some figures which, by the courtesy of the Chief Engineers of the Great Northern Railway and the London and South-Western Railway, have been placed in our possession.

Taking the Great Northern line first, the information is not extensive, but it is surprising, showing as it does, that, vibration notwithstanding, the destruction of mantles is very moderate—indeed, the number is not more than is required under ordinary circumstances to maintain an efficient illumination. We are informed that, the average of new mantles needed for inside lighting is only 2¼ per annum, and for outside lighting 3¼. The experience on this line, with above 5000 incandescent lights of various kinds, is that "the higher the pressure, the shorter is the life of the mantles." "Generally," our informant adds, "the incandescent gas lighting gives satisfaction, and a better light, with a saving in the consumption of gas." Regarding the London and South Western Railway, we have at disposal some particulars as to the financial benefits derived from incandescent gas lighting. Trial results of the Welsbach system were found by the Company to be sufficiently satisfactory to induce a gradual extension; and this has been proceeding during the last few years. Therefore, to-day the Company have a considerable number of incandescent burners in use; and, as opportunity affords, additions will be made. We have been given, by way of example, particulars of the lighting at the under-mentioned stations; and certainly the figures referring to them are extremely interesting:—

—	Date Installed.	Cost of Installation.	Estimated Saving of Gas per Annum.	Cost of Maintenance and Mantles.
Hampton Wick Station	March, 1897	£45	100,000	£5
Wimbledon Station. .	June, 1900	230	1,750,000	50
Nine Elms Goods Shed	March, 1901	300	6,500,000	100
Waterloo Milk Arch .	May, 1901	30	2,250,000	20

These are official figures; and therefore can be relied upon. They carry their own lesson. Calculate the value of the gas saved, deduct if you will the full cost of maintenance and mantles, and then see what relation the net saving per annum bears to the cost of installation. The result is surprising, without giving any consideration to the vastly increased illumination obtained. In one pithy paragraph, our correspondent supplies the Company's experience. He says: "By the incandescent system of lighting, gas is saved, more light is obtained, and the cost of maintenance is not prohibitive or troublesome, if competent men are deputed to look after the mantles and fittings."

We have also before us an independent report on six of the Welsbach Company's high-pressure incandescent lamps which have been installed at the Perth General Station. Each lamp contains a cluster of three burners, consuming together 30 cubic feet of gas per hour, or for the six lamps 180 cubic feet. These high-pressure incandescent lights displaced 82 ordinary flat-flame burners, which consumed, on the moderate calculation of 4 cubic feet per hour, 328 cubic feet of gas. It is reckoned, on present experience, that these high-pressure lights will require an average of six mantles per annum. The area illuminated by the lights is about 330 feet by 65 feet, or some 21,450 square feet. From these figures, the reader can make some interesting computations on his own account.

It is unnecessary to give further particulars to prove, from any point of view, the advantages of the latest scientific methods of gas lighting to railway companies; and in their own interests and to enhance the comfort, convenience, and pleasure of the travelling public, they ought to make the adoption of such systems more general. A long railway journey by night, and observation of the lighting of the stations, will show how great has been the evolution of gas lighting during the last few years. We hope the lesson which may be learned from what we have written will not be lost in the proper quarters, and that old lamps will speedily be exchanged for new.

ELECTRIC LIGHTING MEMORANDA.

The Case of Liverpool—Electricity Supplied at Under Cost—The Infatuation of Local Authorities.

THE more closely the economics of electric lighting are looked into, the more doubtful the so-called profits of the business appear. The case of Manchester has already been commented upon in these columns, and now it must be the turn of Liverpool. It appears there are some pestiferous fellows in Liverpool who decline to take the Corporation electric lighting and power service at the official valuation. Notwithstanding the large scale of the operations of the undertaking, it does not pay. A critic of the Committee's management shows, in a letter to the "Liverpool Courier," that last year they made a loss in actual production of close upon £6000. Only £3500 was transferred from revenue to renewal fund, and nothing at all to reserve fund. The Engineer, in his annual report, lays stress on the importance of making substantial contributions every year to each of these funds, which have to provide for all necessary replacements of plant and apparatus. A dole of £3500 to one fund cannot be regarded as a substantial payment, seeing that the gross investment is over £1,000,000. Of course, this means that the business is being done at less than the cost price, which is hardly a proper state of things. That terrible bogey of all municipal electricity supply undertakings, depreciation, appears under various names in different localities, like an old Pagan deity or fiend, but its attributes are everywhere and always the same.

It is doubly hard when a gas company, heavily rated and with

their own plant to keep up out of revenue, are met on all sides with this kind of municipal trading. The true meaning of maintenance, in connection with a profit-earning undertaking, was stated by Mr. Livesey at the recent meeting of the South Metropolitan Gas Company. They know it in Liverpool also, of course; but for the present purpose it will be preferable to take the illustration from another place. Gas companies do not use the word depreciation, as a rule, because they are careful to provide against the thing, by continually improving the state of their property. As Mr. Livesey told the South Metropolitan proprietors, their works are worth more than the capital cost at which they stand in the books of the Company. They could not be replaced for the money. This has been brought about by careful husbandry in renewing all plant, machinery, and buildings with something always a little better than the old. Money has come out of the revenue account, upon which it is a legitimate charge. There is another fund, called the insurance fund, upon which gas companies can draw in case of accident of any kind. This being their case, gas companies under good management do not need to talk of depreciation, since their plant does not deteriorate or grow antiquated. On the contrary, it continually improves. Very different is the ordinary condition of an electricity supply establishment. The companies that pay do what they can to keep up their plant; but the dead hand of the Electric Lighting Acts has withered their husbandry at its root. Local authorities, with rare exceptions, have not the money to keep themselves in a state of solvency.

The actual condition of the Liverpool electric lighting and power undertaking is bad for the city, and very bad for the Gas Company, who are among the largest ratepayers of the district. It is no amelioration of the circumstances in question to say they are far from being uncommon. Naturally, gas directors and large proprietors, who also happen to be members of local authorities contemplating electric lighting adventures, know more about the facts of the matter than their colleagues who do not see the "JOURNAL." They are precluded, however, from voting upon the question of whether the rates shall be burdened with an electric lighting loan, and even from uttering in the council chamber the solemn warning of the probable results of the speculation which it is really their duty to offer from the abundance of their knowledge. The rule as to the voting of members of local authorities upon questions in regard to which they may be constructively held to have a private interest, is sound in regard to ordinary matters; but in respect of municipal electrical speculations, it has the unfortunate effect of shutting the mouths of those who should know most about the subject. It is lamentable to see in country newspapers reports of district council meetings at which the report of Mr. So-and-so, the electrical expert called in by the council to advise upon the carrying out of the Electric Lighting Order, is adopted in the confident hope, held out by the gentleman referred to, that the rates are to be substantially relieved out of the profits of the proposed undertaking.

Nothing seems to overcome this credulity. The Local Government Board appear to shun all responsibility for cautioning the intending borrowers that the money is certain to be as good as thrown into the streets. The examples of loss and disappointment so abundantly supplied by the experience of those who have already gone the same way, never seem to become known to those authorities who have not yet started; and so the race for insolvency never lacks fresh entries. Next session perhaps some public-spirited member of Parliament will ask a question or move for an inquiry as to the real financial results of the operation of the Electric Lighting Acts as regards local authorities; and then the truth may not only become generally known, but be taken to heart by those most deeply concerned. The matter is of enormous importance for small local government districts, and is no trifle for either the gas or the electrical engineering interest. For it is gratifying to perceive that the infinite multiplication of small electricity supply undertakings, foredoomed to financial failure, is no longer hailed as "progress" by the respectable electrical journals. The conductors of these organs of technical opinion see with us, at last, that the encouragement of small local authorities in this kind of speculation is a mistake, from whencesoever quarter it comes; and they have even begun to implore the Local Government Board to look into the merits of future applications for electric lighting loans.

Patent Office Handbooks.—We have received two recent additions to the series of useful little handbooks to the Patent Office Library which are now being issued, as already notified in the "JOURNAL." One is a key to the classification of the patent specifications of Germany, Austria, Denmark, and Norway; and the other a subject-list of works in chemistry and chemical technology. The key consists of three parts: (1) A translation of the German patent classification, as revised in June, 1900; (2) an abridged index thereto; and (3) an appendix of works in the library supplementing the classified German abridgments and specifications. The subject-list is in two parts: (1) A general alphabet of subject headings, with descriptive entries, in chronological order, of the works arranged under them; and (2) a key, or summary of the headings shown in class order. The list under notice comprises 885 works (79 serials and 806 text-books, &c.), representing 3300 volumes. The catalogue entries relating to these works number 1202, distributed under 146 heads and sub-heads. These useful little handbooks cost 6d. each.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 524.)

WITH the August holiday season in full swing, and with only five days to the working week (the Stock Exchange was closed on Saturday), it is, of course, only to be expected that business in all the markets was very quiet last week. And there was no well-marked characteristic prevalent, for the influential factors were somewhat conflicting. A slight tendency to reaction from the rise prevailed at the opening; and later on the Franco-Turkish incident gave rise to a suggestion of resultant possibilities. But, on the other hand, cheap money and the prospect of peace prompted buying, and some genuine investment proceeded. In the Money Market, there was extreme ease, in view of the over-abundant supply, and some rather expected the Bank of England might lower its rate on Thursday; but no change was made. In the Gas Market, business was very much limited, quite down to the level of holiday low-water mark, and was generally devoid of interest. But the prevailing tendency apparent was firm (as it should be, for gas companies are on the up-grade of prosperity this half year), and prices were higher, with the notable exception of Gaslight and Coke ordinary. This opened at 92 *ex div.*, but relapsed a point; and the closing mark was no better than 90½. From the advertisement put out by the Company, inviting tenders for the unissued balance of £163,190 of ordinary stock, it would appear that the scheme for getting this capital underwritten has been successfully arranged. In South Metropolitans hardly anything was done; and in Commercials nothing at all. Among the Suburban and Provincial group, Brentfords were conspicuous with a moderate advance, which is no more than their deserts. In the Continental Companies, Imperial jumped off at the start with a mark of 210½, and the quotation advanced a point; but subsequent transactions were at lower figures. Among the remoter undertakings, Oriental had a further advance and recovery; and the shares now again stand at a 5 per cent. price for money. In the Water Companies, business was at much about its usual pressure; but transactions were devoid of feature, and no variation occurred in quotations.

The daily quotations were: Very moderate dealings in Gas marked the opening day; and movements were irregular. Gaslight ordinary fell 1; but Imperial rose to a similar extent. Dealings were more restricted still on Tuesday, but movements were more favourable; Brentford old advancing 3, and ditto new 2. Wednesday and Thursday were both extremely quiet, and no changes in quotations were made. Friday, too, was as quiet as any day of the week; but there was some movement, both the fully-paid and the £4 10s. paid of Orientals advancing ¼.

ALL ABOUT PETROLEUM.

ALTHOUGH there is a multiplicity of books treating of petroleum, there was certainly room for another, of the kind which bears the names of Captain J. H. Thomson, His Majesty's Chief Inspector of Explosives, and Mr. Boverton Redwood, the leading petroleum expert of the day.* This is as much as to say, that while there existed treatises and text-books about petroleum in general, there was no comprehensive handbook about legal petroleum, and those official aspects of the subject which practical persons in the trade require to know. Besides, during the last five years, a long and rambling parliamentary inquiry has been held into burning oil and lamps; and the fruits of this inquiry, such as they were, had not been gathered into book form. For these reasons, we welcome the new "Handbook," especially as it bears such unexceptionable names upon its title-page. It is not, of course, in any sense an official publication; but this is no drawback to its promise. As a matter of fact, and before going any further, we desire to state that it is a very good and useful book indeed, and should certainly be in the possession of everyone who deals in or handles mineral oil on a large scale.

In the first place, as was imperative, the book tells us how the term "petroleum" is legally defined. It embraces every mineral oil or product thereof, whether derived from the earth, or made from coal, shale, or other bituminous substance, which, as originally tested in the manner prescribed in the Petroleum Act, 1871, gives off an inflammable vapour at a temperature of less than 100° Fahr. There is no limit to the products which come within the scope of this definition; but mixtures which give off inflammable vapours, such as india-rubber solution, are undoubtedly embraced in it. The strange consequence of defining petroleum in this arbitrary way, with reference to the flash-point only, was that whereas many substances not commonly so styled are legally petroleum, all the actual petroleum of commerce with a higher flash-point than that specified, ceased to be petroleum at all in the eye of the law. This product includes all burning oil. In order

* "Handbook on Petroleum, for Inspectors under the Petroleum Acts, and for those Engaged in the Storage, Transport, Distribution, and Industrial Use of Petroleum and its Products, and Calcium Carbide. With Suggestions on the Construction and Use of Mineral Oil Lamps." By Captain J. H. Thomson, His Majesty's Chief Inspector of Explosives, and Boverton Redwood, Adviser on Petroleum to the Home Office. London: Charles Griffin and Co., Limited; 1901.

to avoid confusion, the practice was adopted of calling petroleum oil those grades of the product which do not come within the meaning of the Petroleum Act, and giving the name of "petroleum spirit" to those distillates which flash under the specified temperature. The most serious consequence of this distinction was that petroleum oil had no legal recognition at all. So long as it had a flash-point above the statutory limit, there were no more limitations upon its transport, storage, or distribution than there would be in the case of so much mineral water.

This result, being out of accord with the dictates of common sense, led to unfortunate incidents. Eventually, Local Government Board and harbour regulations partially supplied the deficiency of the statutes; and these were amended in various ways. The authors of the present book tell in plain language how the petroleum industry originated, and describe its technic in general terms. They are particularly explicit in giving their account of the numerous petroleum derivatives which are at present marketed under various names for different purposes. Evidently, they did not mean that anybody should apply to them in vain for complete information on such matters. This part of the work is indeed admirably done. We are told, among other things, all that it is necessary to know about the ordinary American lamp oil of commerce, the more expensive brand of which is called "water white," and is of limited production. The authors return to this matter again, when they come to deal with the "flash-point" agitation. Every particular in regard to American and Russian petroleums, and the Scotch paraffin oil, is set out conscientiously; nor are coal-tar products neglected.

The all-important matters of "flash-point" and "fire-test" are given an entire chapter to themselves. Here, again, it is necessary to criticize the unfortunate language of the Petroleum Acts, which has been sadly misconstrued. Those who have followed the remarkable Scoto-Radical political campaign, ostensibly directed against American low-flashing oil, will be able to appreciate the point made by the authors, that many people seem to believe that the so-called flash-point is a temperature at which the oil undergoes some physical change, and begins to give off vapour. The Acts, indeed, say that they apply to petroleum which gives off an inflammable vapour at a particular temperature. The fact is, of course, that petroleum gives off vapour at all temperatures; and what the Acts mean is that at 73° Fahr. this evaporation can be detected in legal petroleum, by its igniting at a flame under particular conditions which must be rigidly defined if comparative indications are to be obtained. That is all; and one cannot help thinking that, if the knowledge had been more disseminated, the interested agitation of a few years ago would have been impossible.

The authors explain the working of the Abel test, and note the various ways in which its indications may be rendered unreliable. They roundly conclude from this that the results given by any testing apparatus cannot be depended upon to show the lowest temperature at which any particular oil will produce an inflammable atmosphere under all possible circumstances. To the question naturally suggested by this conclusion: "Why have a flash point at all?" they answer that, though the flash-point is not everything, it nevertheless furnishes a convenient line of demarcation between those products of petroleum which are so volatile as to rank as explosives, and those which are not. The simple line of reasoning which led Dr. Letheby, in 1862, to name 100° Fahr. as the temperature of safety, had nothing to do with the facts of the matter. As he did not specify any method of testing, the figure was meaningless. Fortunately, however, from the assumption of 1862 a standard has arisen which has at any rate served the country's needs, and is still in force.

If there were any real connection between the flash-point of burning oil and the temperature of the atmosphere, obviously when the latter is high there ought to be more lamp explosions than when the air is cold. Yet the recent "heat wave," which brought the temperature of many occupied rooms up to 10° or more above the flash-point of the oil used to light them, did not produce this effect. It is rather curious that there should be so wide a divergence between the indications of the flash-point and the "fire-test," which latter is still used in parts of America, though it has proved too uncertain to win favour here. Complete instructions for testing oil are given in the book; and also for testing the atmosphere of oil tanks, &c., by the "flame-cap."

The book contains an instructive history of legislation relating to petroleum, and a no less instructive review of suggested legislation on the subject. The folly and futility of entrusting inquiries into the merits of Bills to Committees composed of representatives of conflicting interests is exemplified in the history of the Petroleum Committee of 1894. The authors discuss the precautions to be taken in dealing with petroleum in various forms, including the most dangerous. We do not find any reference to the dangers of petroleum hair-washes, though these are considerable. They also criticize with knowledge the design and construction of oil-lamps. It is gratifying to notice that they do not join in the parrot-cry against glass containers for lamps, which is one of the multitudinous "fads" of the London County Council. Everybody knows that a glass container can be as strong as a metal one, with the additional advantage of showing the oil-line and state of the wick, and not sweating. As might be expected, these authorities scout the idea that immunity from lamp accidents is to be purchased at the cost of raising the flash-point, though that would be high. They direct attention to the truth that more people are killed in this country by falling down stairs than by lamp accidents, and note that legislation to do away with storeyed houses is not recommended. They approve, however, of the suggestion that girls in elementary schools should be taught how to trim lamps. A chapter of the book deals with the storage and use of calcium carbide and acetylene; and there are several appendices, giving bye-laws, &c., &c. Altogether, this is a most useful "Handbook."

PERSONAL.

Mr. C. Woosnam, who has held the position of Chairman of the Southend Gas Company since 1878, has relinquished it, but will remain upon the directorate.

Mr. G. W. Anderson, Manager and Secretary of the Caterham and District Gas Company, has been appointed Gas Engineer to the Primitiva Gas and Electric Light Company of Buenos Ayres. Mr. Anderson has held since 1892 the position he is now relinquishing.

For some years prior to last November, Mr. Thomas Canning, Engineer and Manager of the Newport (Mon.) Gas-Works, was a member of the Corporation of that town, and was not only highly respected by his colleagues, but did a great deal of useful work on committees, especially on the one dealing with Technical Instruction, of which he is still Chairman. At the last election, however, owing to laxity on the part of the ratepayers, he failed to retain his seat. The recent occurrence of a vacancy, however, has allowed this mistake, as it was generally regarded, to be rectified; and on Monday last week Mr. Canning was returned unopposed to represent the Central Ward. We congratulate him on his return to a sphere in which his abilities cannot fail to be productive of benefit to the town, of which he is already a Magistrate.

OBITUARY.

Mr. John F. Irvine, Manager of the Kirkcudbright Corporation Gas-Works, died in the Royal Infirmary, Glasgow, last week. Mr. Irvine was appointed to the post at Kirkcudbright only in April last. Before that he was an assistant in the Kilmarnock Corporation Gas-Works. He was a native of Alyth, Forfarshire.

The death occurred on the 15th inst., at the age of 70, of Mr. Thomas Ness, the Chairman of the Middleton and Dinsdale Gas Company. Deceased was proprietor of the Commondale Brick and Pipe Company, and a large shareholder in several of the local industries. He was very highly and widely respected—his business connections bringing him into contact with most of the towns in the North of England.

Mr. William Fletcher, for a number of years a popular and esteemed official of the Birmingham Gas Department, died last Tuesday. More than 40 years ago, Mr. Fletcher became a collector in the service of the old Birmingham Gaslight and Coke Company. Rapid promotion was the reward of his qualities; and it was not long before he became Superintendent of the office staff. The Corporation purchased the Company's undertaking in 1875; and after the retirement of Mr. Joseph Slocomb, who at the time filled the office of Secretary, Mr. Fletcher carried out the secretarial duties until the Birmingham and Staffordshire Gas Company's business was also taken over. Mr. Parry was appointed Secretary of the amalgamated undertaking. He was succeeded in 1878 by Mr. Edwin Smith, and about that time Mr. Fletcher, who had rendered valuable assistance during the transition period, became Chief Cashier. This position he continued to hold until the close of his official career. Being 65 last October, Mr. Fletcher should, in the ordinary course, under the compulsory clause of the superannuation scheme, have retired; but, on the Gas Committee's recommendation, the City Council extended his period of service for another year. Failing health, however, necessitated his retirement before the expiration of that period; and his official connection with the department was severed last May. Mr. Fletcher had many friends; and his death will occasion keen regret to all who knew him.

A New Kind of Gas Tubing.—A new kind of gas tubing is put on the American market, according to the "Scientific American," which is recommended for use where there is any risk of the rubber being burnt, as in gas-cooking stoves, ironing, chemical works, &c. The rubber tubing is covered with finely woven braid of asbestos, and further with incombustible paint, which will withstand a great amount of heat. Numerous accidents occur through the tubing coming in contact with the gas-flame or with heated materials; and the new article possesses advantages over ordinary rubber tubing in this respect.

Expeditious Loading of Vessels with Coal.—A striking example of the improvements which have been made in the mechanical arrangements for the loading of coal from railway trucks into vessels has recently been afforded by a new hydraulic coal-hoist erected at the Penarth Dock. According to some particulars in "Nature," a steamer arrived in the dock at 8.10 in the morning. After taking in sufficient coal for her boilers, she proceeded to load her cargo at 9.15, and the work was completed at 11.50—the steamer entering and leaving the dock on the same tide. The quantity of coal placed in the vessel was 2333 tons, and it was done in 2½ hours, or at the rate of about 15 tons a minute.

WATER-GAS INSTALLATIONS ON THE STRACHE SYSTEM.

(*Continued from p.* 444.)

The foregoing account of Dr. Strache's water-gas plant, based on the statements of the firms who supply the apparatus, will certainly leave an English gas engineer with an impression that only one or two of the five types of the plant described merit serious consideration. Type A, for instance, is merely for the production of simple water gas from coke or anthracite. It will not, therefore, be useful on English gas-works, unless the unusual expedient of carburetting the water gas with benzol be resorted to. Like the Dellwik plant, it is mainly serviceable for the supply of water gas for use in factories, &c. And perhaps, in justice to those responsible for the standards of quality embodied in most English Gas Acts, it may be worth while to point out that they had no knowledge of means of imparting illuminating power to gas such as that presented by the processes for carburetting it by the aid of benzol and carburine. Illuminating gas, about a decade ago and earlier, was only coal gas, with perhaps an addition of cannel gas. Legislators were then justified in assuming that the heating value of gas bore a certain tolerably definite relation to its illuminating value. The latter was at that time by far the most important quality of the gas to the consumer; but so long as the then prevailing method of keeping up illuminating value was alone employed, the imposition of a standard of illuminating power on a gas undertaking indirectly imposed also a standard—undefined, yet capable of tolerably exact definition—of calorific power. But with the development of other methods of providing and maintaining the illuminating value of gas—and especially of the process of carburetting water gas by means of benzol—the relation between the illuminating power and the calorific power of gas became very indefinite, and compliance with a prescribed standard for the former quality ceased to be a safeguard for the maintenance of a certain calorific value.

Some will prefer to regard this as an instance of legislation lagging behind technical progress; while others will brusquely describe it as an illustration of the common disposition to devise means to frustrate the obvious intention of legislators. Whichever view is held, however, it must be generally admitted that carburetting water gas by means of benzol (or carburine), with a view to supplying it in place of an equal volume of coal gas, is a subterfuge which can only be of value so long as illuminating power is the sole statutory criterion of the quality of a gas supply. And as it must be admitted that the great increase in the use of gas for heating purposes and for lighting by incandescence has rendered the illuminating power test of little value, so will gas engineers have as little as possible to do with such subterfuges as benzolized water gas, pending a general revision of legislative enactments respecting the quality of gas supplies. Hence it is unlikely that they will be much attracted by Dr. Strache's Type A plant, though we understand two sets of this type are already in use as an auxiliary to coal-gas plant at one Continental gas-works. In this case it was thought desirable to increase a maximum daily output of 2,825,000 cubic feet of coal gas to a maximum output of 3,500,000 cubic feet; and it was decided to attain this end by means of benzolized water gas. Two sets of the Type A plant were therefore erected, each capable of producing a maximum of 420,000 cubic feet of water gas per diem. The water gas is carburetted to 14-candle power with benzol. It is estimated that when the coal-gas plant is in full operation, and the water-gas plant is used to bring the total output up to 3,500,000 cubic feet per diem—an increase of 25 per cent. on the make from the coal-gas plant alone—the amount of coke for sale is only decreased by 6 per cent. Valuing coke at about 20s. per ton, and benzol at 9½d. per gallon, and allowing for two shifts of three men each to work the plant, the cost of the carburetted water gas is given as a little under 1s. per 1000 cubic feet, exclusive of management charges, interest, &c., but inclusive of an allowance for repairs, the cost of purification, and boiler fuel, &c. It is not quite clear from the papers before us whether these statements as to the cost of the gas are the actual working figures for the plant in question. The Type A plant is already in use for various purposes at no fewer than eight towns on the Continent.

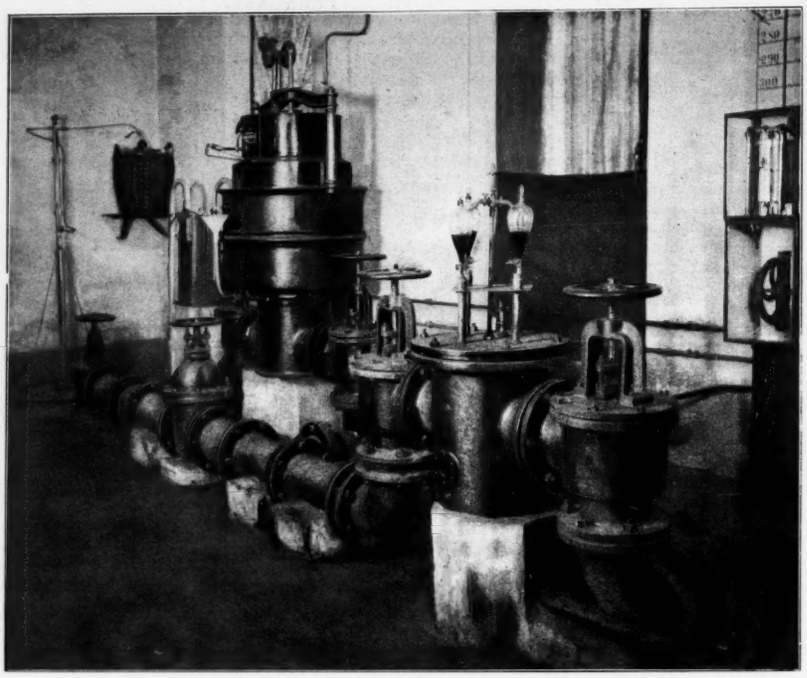


Fig. 5.—Pettau (Styria). Apparatus on the Working Stage.

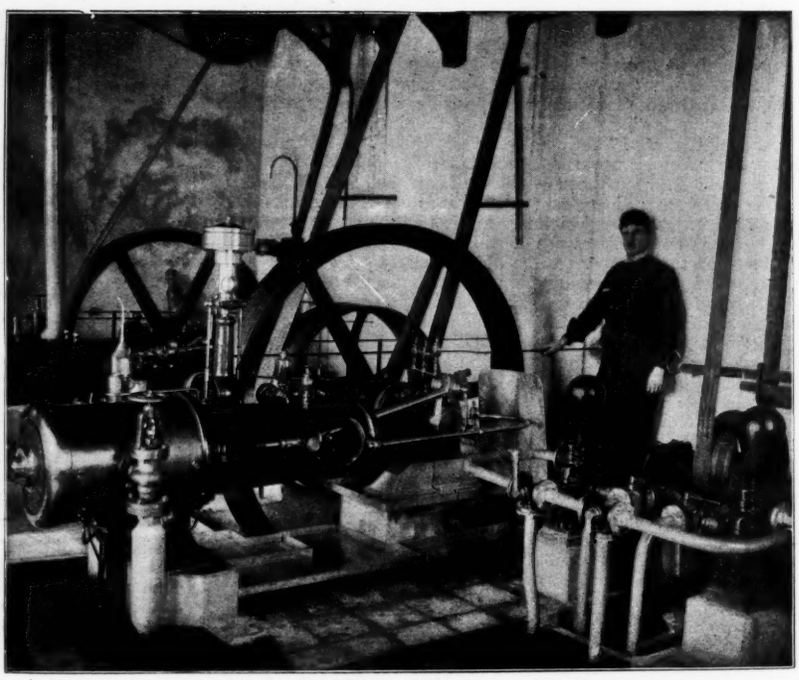


Fig. 6.—Pettau (Styria). Engine-Room.

Type C is intended for the use of coke or anthracite only, and mainly for the production of water gas carburetted with mineral oil. It will not, therefore, be of much interest to the English gas engineer, unless it can be shown to be in some respect superior to the prevalent Lowe types of plant, and in other respects their equal. The description appears to us to betray no evidence of superiority of design. Moreover, the papers before us do not indicate that this type of plant is actually in use at any works.

Type E is a very interesting one, in view of the fact that it is

intended to deal with small fuel. But the details given of it are, as already remarked, too meagre. There seems to be one set of this type in actual operation—apparently for the supply of simple water gas to a small Russian town for lighting and heating purposes. Its maximum daily output, without the use of a blower, is 17,000 cubic feet; but it may be nearly doubled by bringing into use a blower, driven by (say) a gas-engine. For an annual output of 2,825,000 cubic feet, without the use of a blower, day and night working must in the winter be resorted to. This, with day work only in other seasons of the year, gives 1s. 4d. as the cost of 1000 cubic feet of water gas (purified and odorized) produced from coal costing about 17s. per ton. The cost is somewhat reduced when the fan is brought into use and a larger output secured from the plant. It must, of course, be borne in mind that the plant in question is a very small one, and that the figures as to cost of gas are consequently not comparable with those referring to larger plants.

The remaining plants—viz., Types B and D—are those which present the most interesting features to English engineers. Both admit of the use of coal in the generator; and Type D may be used for the production of carburetted water gas from mineral oil. The scheme for carbonizing coal in the upper part of the generator by means of superheated steam is certainly highly ingenious, and deserving of serious consideration. The part of the process which, according to the generally accepted ideas of the present day, appears at fault is the subsequent breaking up of the gaseous hydrocarbons and ammonia into elementary gases, with the object apparently of merely obtaining perfectly non-illuminating gas and a slight increase in volume. This may be a reasonable, and even necessary, course when the gas is required for certain industrial uses only; but when it is to form part, or the whole, of a town gas supply, the expediency of breaking up the hydrocarbons and ammonia is by no means so evident. It would certainly be worth while attempting to modify this part of the process so as to retain gaseous hydrocarbons in the ultimate product, and recover ammonia as a bye-product. To set about deliberately to break up ammonia into its elements—only one of which has any heating value—is a procedure which undoubtedly demands more adequate justification than Dr. Strache offers.

Type B appears to be an extensively adopted plant. Some particulars are given of one installation of considerable capacity, and of other smaller ones. The large installation (which is for a town supply of simple water gas) comprises two generators each for a maximum make of 17,500 cubic feet per hour, and two generators each for a maximum make of 10,500 cubic feet per hour. The maximum make per 24 hours of the whole installation is 1,270,000 cubic feet. It is intended for an output of 140,000,000 to 210,000,000 cubic feet per annum. Using coal costing 17s. per ton, the cost of the gas made, inclusive of all charges except the salaries of officers and interest on and redemption of capital, amounts to 5¾d. per 1000 cubic feet. This includes the cost of purifying and odorizing the gas. A smaller installation of this type of plant for the production of simple water gas for industrial uses shows a somewhat lower cost per 1000 cubic feet—viz., 5d.

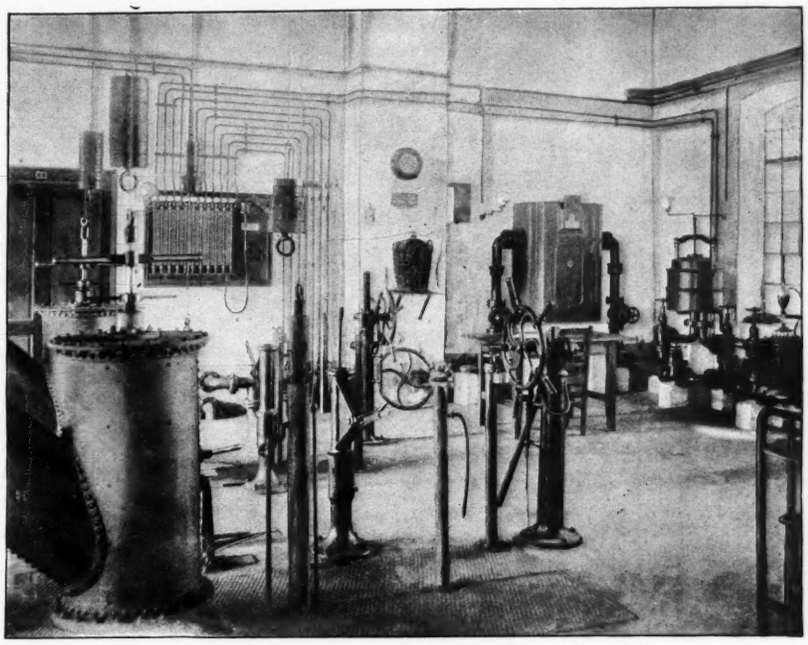


FIG. 7.—GAS-WORKS AT THE STATE RIDING SCHOOL AT SCHLOSSHOF (LOWER AUSTRIA). WORKING STAGE OF THE STRACHE WATER-GAS PLANT.

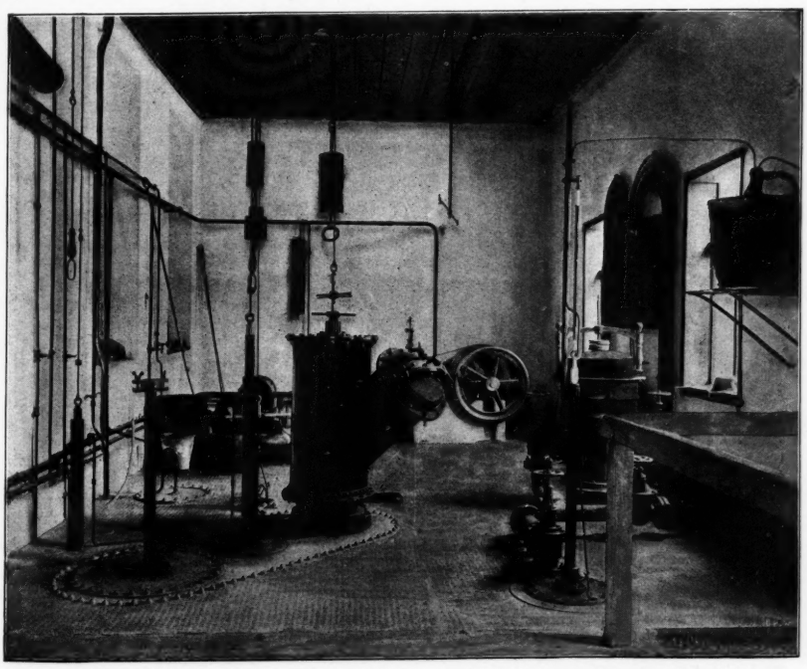


FIG. 8.—GAS-WORKS AT THE UNIVERSITY OF CZERNOWITZ (BOHEMIA). WORKING STAGE OF THE STRACHE WATER-GAS PLANT.

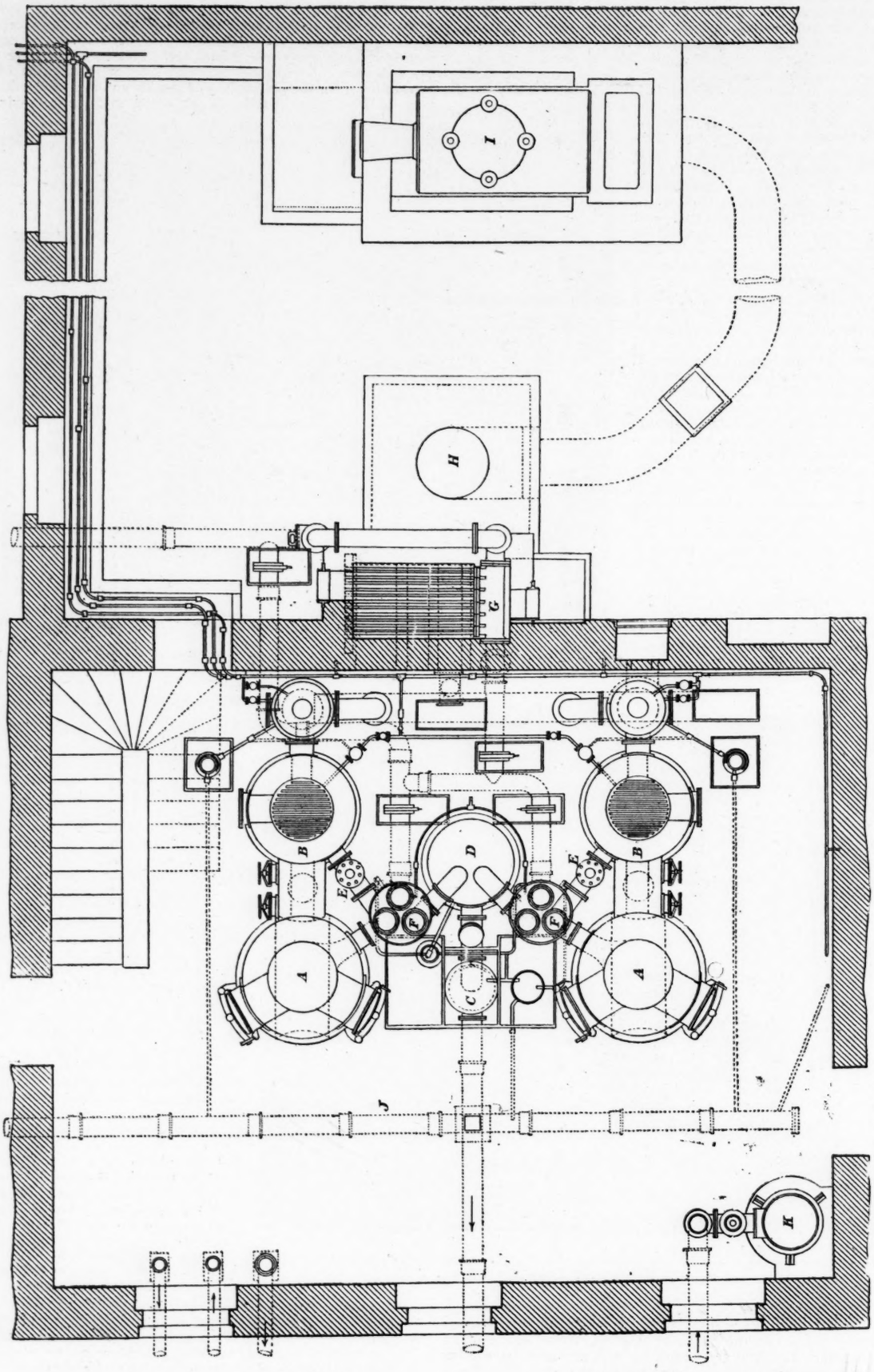
The charges for purification and odorizing appear less in this instance. Coal is put at the same price in both cases.

Type D plant is used at one gas-works to produce carburetted water gas for the purpose of increasing the output of the works, which has plant for a make of 350,000 cubic feet of coal gas per diem. The water-gas installation comprises only one set of a maximum productive capacity of 84,000 cubic feet per diem. Coal may be used in the generator, if the gas is carburetted with benzol; but if it is to be carburetted by the cracking of oil, it seems that coke or anthracite must be employed. Hence, so far as the production of water gas carburetted by means of mineral oil is concerned, it is not apparent that this plant gives any greater choice in the matter of fuel for the generator than does the ordinary Lowe plant. Taking benzol at 1s. 2½d. per gallon and coal at 17s. per ton on the one hand, and mineral oil at a little over 60s. and coke at 20s. per ton on the other, the working of this plant is said to show that 14-candle gas costs 1s. 4d. per 1000 cubic feet when mineral oil and coke are used, and 1s. 5¾d. when benzol and coal are employed. For this comparison, benzol has been valued at a high figure, with the object of indicating the price to which it must rise before carburetting with mineral oil becomes appreciably cheaper.

The foregoing details of Dr. Strache's water-gas plants may be appropriately supplemented by some views of existing installations. In the first place, figs. 5 and 6 show the installation at Pettau, in Styria. This small town is supplied with simple water gas, duly odorized, from plant owned by the Municipality. The small town of Rzeszow, in Galicia, also has water-gas plant on Dr. Strache's system, owned by the Municipality. Both at Pettau and Rzeszow the water gas is used without carburetting, and without admixture with coal gas. For lighting purposes, incandescent burners, of course, must be employed. Fig. 7 shows the working stage at the Imperial Riding School at Schlosshof, in Lower Austria, where Dr. Strache's plant has also been adopted. The working stage of a similar plant installed at the University of Czernowitz, Bohemia, is shown in fig. 8.

INSTALLATION OF STRACHE WATER-GAS PLANT AT PETTAU.

GROUND-FLOOR PLAN, SHOWING ARRANGEMENT OF PLANT.

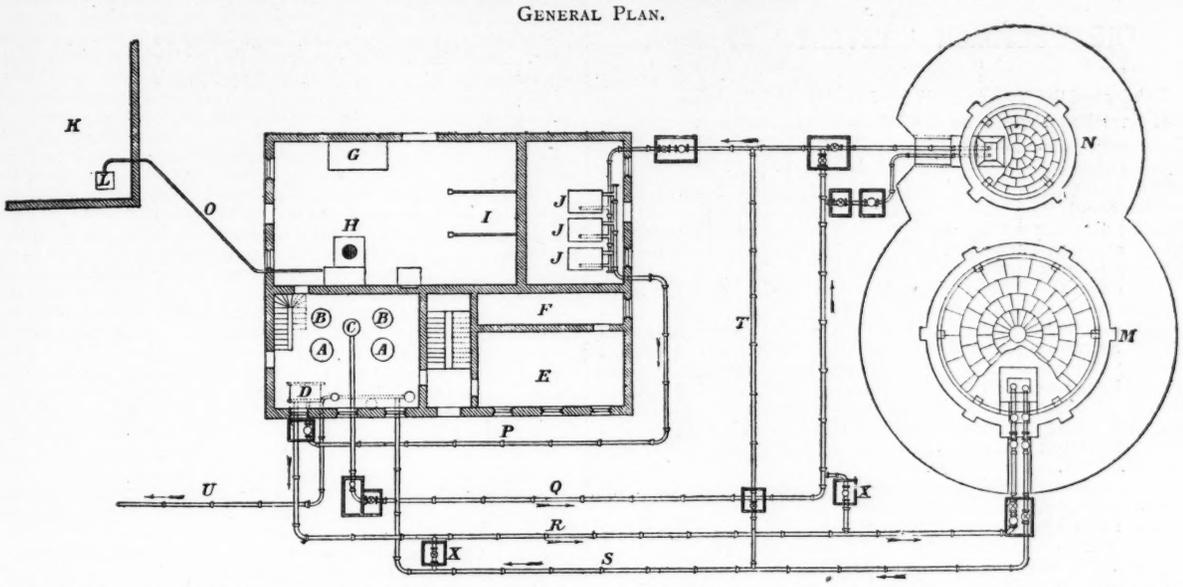


A. Generators. B. Superheaters. C. Condenser. D. Scrubber. E. Secondary-Air Valves. F. Change Valve. G. Air Recuperator. H. Chimney. I. Steam Generator J. Water Discharge Pipe K. Drying Vessel.

With the illustrations on pp. 504 and 505, and two diagrams reproduced from our Paris contemporary, "Le Constructeur d'Usines à Gaz," we must conclude the present account of the Strache plant; but we hope shortly to refer to the incandescent burners designed by Dr. Strache for the consumption of simple or uncarburetted water gas.

INSTALLATION OF STRACHE WATER-GAS PLANT AT PETTAU.

General Plan.



A. Generators. B. Superheaters. C. Scrubber. D. Meter. E. Workshop. F. Photometer Room. G. Steam Generator. H. Chimney. I. Coal-Store. J. Purifiers. K. Engine and Boiler House. L. Blower. M. Principal Gasholder (10,600 cubic feet capacity). N. Intermediate Holder (3600 cubic feet capacity). O. Air-Pipe (6-inch). P. Pipe (4-inch) from Purifiers to Meter. Q. Pipe (7-inch) from Scrubber to Intermediate Holder. R. Pipe (4-inch) from Meter to Principal Holder. S. Pipe (7-inch) from Principal Gasholder to Outlet-Valves. T. Pipe Connecting the Two Holders. U. Main Supplying the Town. X. Bye-Passes.

NOTES.

High-Power Gas-Engines for Ships.

In a recent number of "Dinglers Polytechnisches Journal," Mr. R. Mewes advocates the employment of high-power gas marine engines. He specially emphasizes the superior thermic efficiency of gas-engines as compared with steam-engines, and demonstrates that the storage bunkers would be much less with the former than they are at present on vessels destined for foreign ports. He admits the inconveniences of gas-engines, mainly due to the defects still existing in their construction, and recognizes the danger of fire and explosion of gas-generators and of the high-pressure pipes required for fuel gas. He explains, however, how these inconveniences can be avoided. To make his argument more effective, he takes the *Kaiser Wilhelm der Grosse* as an example, and shows how large an amount of space could be saved by adopting gas-engines. On this ship the engines occupy 164 yards out of the 207 yards which is the total length of the vessel. The capacity of the coal bunkers is 206,140 cubic feet; that of the fresh-water tanks, 8263 cubic feet; and the boiler space is 52,965 cubic feet. Steam production requires a total space of 264,825 cubic feet—viz., one-third of the ship's maximum displacement. With thirty gas-motors of 1000-horse power, with a thermal efficiency of 24 per cent., instead of 12 per cent. for steam-engines, one-half the space now required for supplies could be saved, and the boiler-rooms could be utilized for some other purpose. Thus 141,240 cubic feet could be economized.

American Gas Wells.

It is not an easy matter to obtain reliable statistics relating to the course of the natural oil industry of the United States. It appears from a recent statement that the first stage of lavish waste of this unique product has everywhere been succeeded by strict husbanding in its distribution, as the exhaustion of some gas wells has demonstrated to be highly necessary. Consequently, the gas is now all metered. It is being extensively used for lighting by incandescent mantles, which effect a great saving. The diminution of the pressure at the outlet of the wells is the first serious indication of approaching exhaustion; and in the older natural gas-regions of the State of Pennsylvania the well pressures have become much lower of late years. Some of the oldest companies are selecting the uses of their product with greater discrimination; and the direct application of gas to the production of motive power by means of gas-engines has superseded the wasteful practice of burning it under steam-boilers. It is believed that there are upwards of 5000 miles of mains conveying natural gas in Pennsylvania; and the greater economy with which the product is used will probably prolong the life of the wells for very many years. In the State of Indiana, where there is an equal mileage of natural gas-mains, the well pressures have fallen from 325 lbs. in 1886 to 181 lbs. during the last two years. When it is understood that practical men in the business do not consider that the majority of the wells can be profitably worked at a pressure below 100 lbs. per square inch, the importance of this steady diminution of the average pressure can be appreciated. The most promising districts for natural gas are now West Virginia and Canada, both of which are comparatively new fields. When a gas well gives out, it fills up with water; and as this trouble makes its appearance some time before exhaustion of the gas, it entails a good deal of extra engineering work in and about the wells.

Radiation of Incandescent Gas-Burners.

In the "Revue Générale des Sciences," Dr. Guillaume, of the French Office of Weights and Measures, discusses the laws of radiation in reference to their application to the case of incandescent mantles in gas-burners. He considers that the high intensity of the Welsbach light is partly due to the fact that the coefficient of radiation of the mantle is exceptionally high towards the blue end of the flame spectrum; partly to the temperature of the flame itself being higher than has been commonly supposed; and partly to the density of the radiating substance being largely in excess of that of the carbon in an ordinary combustion flame. The high temperature of the mantle is probably attributable to the fact that its coefficient of radiation decreases rapidly towards the red and infra-red end of the spectrum; so that the total radiation is relatively small in comparison with the radiation of rays of short wave-length. The work of Le Chatelier and Boudouard is cited in this connection; and Dr. Guillaume suggests that the coefficient of radiation of Welsbach mantles for infra-red rays presents an interesting field of study. He thinks it probable that as the wave-length of the rays increases, the coefficient may diminish to a minimum, and may increase again in a region considerably distant from the visible spectrum. This is because the substances entering into the composition of a Welsbach mantle exhibit gaps in an easily explored region of their emission spectrum, and so possibly show results differing considerably from those furnished by substances having a more nearly uniform radiation.

Comparison of Oil and Gas Cooking-Stoves.

It is reported that the interests identified with the sale of American petroleum burning oil in this country are pushing a new patent wickless blue-flame cooking-stove for this purpose. Although the spread of automatic gas-meter supplies for cooking-stoves in small households has considerably checked the demand for oil cooking-stoves in English towns, in country places the cheap, flimsy petroleum cooker, with wicks, is still much in use. The proper handling of a wick oil-burner is, however, a troublesome business, on account of the frequent trimming and refilling required. In the wickless style of oil-stove, an approximation is made to the convenience of the gas-stove by fitting it with oil reservoirs worked on the principle of the bird fountain. From the reservoir the oil flows to a burner in the form of a bowl, with an asbestos plug for starting the combustion. The heat of this starting-flame vaporizes a regulated proportion of the oil in the burner, which, after admixture with air, burns as a blue flame, giving intense heat. In an American test, it was found that for cooking purposes in this way the equivalent consumption of oil and gas was 4·27 gallons (Winchester) of oil to 1000 cubic feet of 18-candle gas. This was probably not the worst the oil could do; and the figures afford the necessary data for making the comparison between oil and gas cooking in any locality. Probably for the sake of simplicity and keeping to round numbers, it might be said that the relative consumption of oil in the latest form of American blue-flame cooking-stove is claimed to be 4 Imperial gallons equalling 1000 cubic feet of ordinary illuminating gas.

COMMUNICATED ARTICLES.

THE WELSBACH "PATENT" OF 1893.

Readers of the Press are all too familiar with the many actions that have been begun by the Welsbach Incandescent Gaslight Company against so-called infringers of their "patent" mantles for incandescent lighting; but few people perhaps realize that, if the British Patent Laws were anything like right, none of these actions could have been commenced at all. The history of, and the injustice caused by, these Welsbach "patents" form a rare commentary on our patent system, which has been truly termed "a standing disgrace to the country."

The original Welsbach patents of 1885 and 1886, which were ultimately refused a monopoly in Germany and the United States (where examination as regards novelty and validity exists) were upheld as master patents in this country (where there is no kind of prior examination as regards novelty and validity), to the undoubted detriment of the gas industry of the United Kingdom. But, some six or seven years ago, even the qualified patents that had been granted in Germany were revoked, because the specifications were not in accordance with the manufacture of the mantles as carried out.

Even as late as 1886, thorium was commonly known in the incandescent mantle industry as *commercial* thorium, which contained a small proportion of cerium, though this was presumably unknown at the time to chemists and inventors of incandescent mantles. It was only between 1885 and 1887 that Professor Nilsen and Dr. Krüss were successful in extracting the last traces of cerium from (and which so pertinaciously clings to) thorium oxide. This discovery was of the greatest importance to the lighting corporations in Germany and elsewhere on the Continent in their actions with the Welsbach Companies there—years before even the 1886 Welsbach patent in this country expired.

Chemically pure thorium (as obtained after 1887) of itself gives very little light. Consequently, when using the pure thorium, it was necessary to add a small proportion of cerium in order to produce mantles of real commercial value—giving a beautiful and powerful light—and make incandescent lighting a success.

Under the 1885 and 1886 patents, no cerium was supposed to be used. But, all the same (up till 1887, at least), cerium was used when thorium known as commercial thorium was in vogue; and, undoubtedly for many years past the Welsbach Company (as now called) have been using cerium in the manufacture of their incandescent mantles.

All this was latterly known to the New Incandescent Sunlight Company, between whom and the Welsbach Company important law actions had been raised. Had these actions been allowed to be fought out to a finish, matters would doubtless have been settled for good; justice would have been done; and the rights of the public would have been restored and fully protected. Apparently, however, the interests of the gas or lighting trade and the interests of the public were quite secondary matters in the eyes of the Welsbach and the New Sunlight Companies. Both of these Companies have seemingly found out that, if the truth was to prevail, and if the rights of the lighting trade and of the public were to be studied, the whole of the patents of both Companies would have to go by the board. Consequently, last year (and just before the first important decision was to be given in Court), the Companies decided to amalgamate, abandon the actions-at-law on both sides, and so try to keep up their monopoly a little longer.

The 1885 and 1886 British patents were, of course, due (through lapse of time) to expire in 1899 and 1900 respectively, when the monopoly granted by these master patents would cease. Early in January, 1893, while in Paris, this unpleasant prospect appears to have struck Mr. Julius Moeller (the then General Manager of the Welsbach Company) rather forcibly, and Mr. Moeller—who was neither chemist, engineer, nor gas expert—sent over hurried instructions to apply for a British patent for the production of mantles for incandescent lighting by the addition to thorium when in a pure state of from 1 to 2 per cent. of cerium or other similar rare metals. This was done. It was transparently (as was stated by Counsel in Court the other day) simply and solely a patent for trying to extend the monopoly obtained by the 1886 patent, notwithstanding that it had lapsed. This forms the much-talked-of 1893 patent, which expires in 1907, and which alone now gives the Welsbach Company any monopoly in incandescent mantle manufacture in this country, and any right to sue the lieges, and even imprison them for contempt in the manner so frequent of late.

So hurriedly and carelessly was this 1893 patent framed, that as the termination of the 1886 patent came nearer, and the probable value of the 1893 patent became more perceptible, it was found advisable to amend the 1893 patent. This was accomplished in July, 1899, whereby the claim was much limited, but certainly not altered for the better in the circumstances. What the Welsbach Company and their counsel claim under their amended 1893 patent is the sole right to make an incandescent mantle of thorium with a small percentage of cerium; and the Company already boast that they have obtained some 800 interlocutory injunctions on the 1893 patent against so-called infringers or against sellers of mantles made by others using the same rare metals in similar proportions.

Unfortunately for the Welsbach Company, but fortunately for the public, the Welsbach Company have overreached themselves, as what has been patented and what is claimed under the 1893 patent was *public property* in this country in the beginning of 1891. That this was so is shown, fully, by the fact that a paper on incandescent gas-lighting, read by Mr. W. Mackean, F.C.S., (the Chemist-in-Chief of the Welsbach Company) before the Society of Chemical Industry on Feb. 16, 1891, contained full details as to the manufacture of the mantles, with the percentages of the rare metals giving the best results, based on his experience of three years previous to February, 1891. In his paper, Mr. Mackean not only showed by data that it was his practice to use 2 per cent. of cerium with thorium; but he gave tables of duration-tests of Welsbach mantles made by the use of cerium and thorium, and showing the presence of an excess of cerium in the lighting fluid. Further, at the end of the discussion which ensued, Mr. Mackean indicated that his Directors were cognizant of what he had been laying before his audience, and that thanks were due to them for allowing him the necessary time for working out the experiments. The whole paper and discussion appears in cold print in the "Journal of the Society of Chemical Industry" for March, 1891, pp. 196 to 201 inclusive.

The second fact is that about the same time—*i.e.*, early in 1891—Mr. Julius Moeller published a circular from the Welsbach Company's office, practically giving the same information, and indicating that by the use of two rare metals only, mantles could now be produced, each giving from 70 to 80 candles and an average duration-test of 1000 hours—the two rare metals referred to being, of course, pure thorium and 1 to 2 per cent. of cerium.

As priority of publication—even in Great Britain—invalidates any patent, and as the documents referred to were in print and published nearly two years before the date of the application for the 1893 patent, and nearly three years before its acceptance, there need be no question about the worthlessness of the 1893 patent, whenever there may be an opportunity for its adjudication before a competent tribunal.

It will scarcely be believed that some short time ago the Welsbach Company succeeded in getting a Judge to grant a certificate of validity for their 1893 patent, in a case which was undefended. But this certificate cannot fail to be upset should the patent ever be properly tested for novelty and validity with the evidence now shown at disposal.

The present policy of the Welsbach Company appears to be to deliberately refrain from attacking genuine makers of incandescent mantles, who are able to defend themselves, but instead to prosecute the small sellers of mantles who cannot defend themselves—such as hawkers with barrows and the like—who are pleased enough almost to pay anything to settle and so save further evils. For continuing to sell after having been dealt with by orders of the Court, some of these poor men have even been sent to prison! All because the Company have been granted a patent which has either been refused or revoked if granted in every other country in the world where there is any form of prior examination in reference to the granting of patents.

From bills sent out last week by the Welsbach Company, a bolder method of procedure is apparently in contemplation. The public are warned that a certain well-known mantle is an infringement; and it is definitely stated that actions will be brought against all dealers and users of the "Guaranty" or "Dura" mantle. These statements can be taken for what they may be worth. No mention, however, is made of the fact that the makers of these very mantles are not being prosecuted—only the dealers and users being threatened.

The "Guaranty" or "Dura" mantles are made by the United Chemical Works, who appear to have at their command the important evidence held by the New Incandescent Sunlight Company when in conflict in the Courts with the Welsbach Company; and probably that may be one of the reasons why the Welsbach Company prefer apparently to try to cripple or to ruin them by threatening and attacking their customers, instead of by openly prosecuting the United Chemical Works themselves.

One of the customers of the United Chemical Works—*i.e.*, the Intensified Gaslight Company, Limited, had proceedings taken against them on the 15th of May last by the Welsbach Company for buying and using mantles made by the United Chemical Works. The writ was issued on June 12, and an interlocutory injunction was granted by Mr. Justice Lawrance in Chambers against the Intensified Gaslight Company, notwithstanding that it had already been held in a previous case that the United Chemical Works (from whom the Intensified Company purchased their mantles) were entitled to make and sell these mantles. The case came before the Court of Appeal on Monday, the 5th inst., when it turned out that the Intensified Gaslight Company had actually made a previous agreement with the Welsbach Company under which they (the Intensified Company) undertook never to raise any objection to, or contest the validity of, the patents of the Welsbach Company. This naturally put the Intensified Company almost out of Court. In the peculiar circumstances, and on a suggestion from the Judges, the injunction was allowed to stand till the trial of the action, on the Welsbach Company agreeing to supply the Intensified Company on trade terms with all the Welsbach mantles they might require in the interim.

Since then, however, the Intensified Company have issued a circular, dated Aug. 10, stating that they have been restrained from selling "Guaranty" mantles supplied by the United Chemical Works and that *they find* these mantles to be an infringement

of the Welsbach Company's patents, and winding up by the following announcement: "We are now, under a licence, selling Welsbach mantles for use with our burners; and we shall be happy to supply them to you as before." For this circular, doubtless, the Intensified Company will be prepared to accept full responsibility; only it does appear strange that such a definite statement *re* infringement should be so publicly made when it is well known that no decision on the point has ever yet been arrived at. From the tenor of the circular it would seem as if a settlement had been arrived at between the Welsbach Company and the Intensified Company, and that no more may be heard of the action. In any case, the result appears to be that the United Chemical Works have lost a customer and the Welsbach Company have gained an agent. Thus, the policy of the Welsbach Company—in agreeing under pressure to grant full trade terms to some trade customers while absolutely refusing them to other trade customers, and in getting the better of other manufacturers of mantles through the customers of these makers or opponents, instead of taking action against the manufacturers themselves—continues to be characteristically regular but apparently pursued in defiance of the true interests of trade. It seems therefore highly essential that the Attorney-General be immediately requisitioned to deal or to cause to be dealt with once and for all the question of the validity of the 1893 Welsbach patent.

At present, as regards the incandescent mantle question alone, and in comparison with America, Germany, France, Austria, Belgium, and other countries on the Continent where incandescent mantles are made, sold, and used on commercial lines and without monopoly, Great Britain is severely handicapped and that principally in this instance at least because of her antiquated patent system.

As regards undue competition from the Continent and elsewhere in incandescent mantles, there is said to be about 2 gallons of alcohol latent in every 1000 incandescent mantles. If this be so, perhaps, instead of cutting at ruinous prices, the difficulty might be met by calling the attention of the Excise Authorities to these mantle importations, when possibly the revenue of the country would be increased and the British manufacture of incandescent mantles protected, without putting any burden on the purchasers or users.

GAS MATTERS IN THE UNITED STATES.

Contest for Control of the Steatite Industry.

On the face of it, this is only a family quarrel, a contest concerning the private affairs of a family in Chattanooga, Tenn. Below the surface, it appears to be a battle between two groups of capitalists to control an industry for which they foresee a great future. It began in a directors' meeting to control the policy of a small company for manufacturing "gas-burner tips and other like articles;" and it has grown to a contest involving millions of dollars. If a firm of lawyers in this city are to be believed, changes in the structure of the gas-burners to be used under mantles are in prospect, almost as important as the invention of the mantle *per se*.

The struggling interests seem to be trying to obtain possession of every acre of ground from which this silicate can be dug in any form. They seem to be as anxious for talc as for meerschaum; and they will not tell what they want it for. Wild stories are current of new uses—crucibles and "clotures" (whatever they are or may be) are mentioned, also furnaces to sustain the highest temperatures, and a thousand-and-one other things. Incidentally some very interesting apparatus has been shown, but nothing whose practical commercial value can justify the outlay, unless it be the new burners to use with the Welsbach mantle. In these, the steatite core fills the larger part of the space within the mantle, and is symmetrical with it, although, of course, somewhat smaller. This contest has a funny side. It happens that the original industry was established on a very small scale, and was owned by the very men who worked at the bench. Consequently, the efforts of the rival interests are described as an attempt to crush out the small independent workman made by that so chimerical monster the selfish and reckless capitalist.

Local Ownership Agitations.

The fact—for it is a fact—that the people of this great and glorious country are intensely clannish, that the man of one township, county, and State has an intense dislike of the man from the adjacent township, State, or county (in fact, is jealous of him because he is an outlander) has been noted so frequently that no real harm is done by saying so once and again. At the same time, it must be remembered that the feeling of clannishness is purely with reference to the locality. Of course, when exhibited in trifles, this feeling partakes of the pettiness of the trifles concerned; but when great interests are involved, it may be serious. It, however, never shows what it can do except in the State Legislatures, and in reference to public service corporations. It takes on its most virulent shape when the "scholar goes into politics." Every little while some young man with money is graduated from some Western College, and determined to devote his life to carrying out in practical politics what he has been taught. A number of such men have established a "Cities' Rights Defenders League," and have issued circulars asking for adhesion to their party. In the circular is a "whereas and a therefore," which amounts to about as follows: After mentioning the fact that valuable franchises are constantly given away to the citizens of "foreign States," it proposes that all franchises for public service corporations shall be initiated by city councils, who, having determined just what service is needed, shall ask for bids for the privilege of rendering it—exactly inverting the present order as exhibited, for instance, in Philadelphia. It further provides that, if the corporation obtaining the privilege is a foreign corporation, then a local one shall be formed to work the franchise; and in every instance the majority of the directors shall be citizens of the city, county, or State in which the service is rendered. It is said that means are being taken to introduce Bills to give this notion a practical influence in no less than fifteen of the States; and it is confidently expected that the proposed law will be enacted in nine of them.

Obviously there is room for great discussion *pro* and *con* in the matter; and feeling is expressed that much trouble will follow in numerous places for corporations owning gas-works. I have written letters to a number of prominent lawyers who are connected with various interests considered to be affected by the proposed legislation; and many seemed to regard it as the logical result of the decisions of the Courts. One of my correspondents writes: "You may be very sure that the ownership of all the shares in a corporation by one individual will never be held to change the purely artificial position to anything approaching a natural one. It is my opinion that the purchase of corporations, especially city lighting corporations, either gas-works or electric light plants, by small groups of investors, and their assumption of rights which belong neither to them as individuals nor to the corporations as such, has done more to advance the cause of municipal ownership in the United States than all other causes combined. The action of the interest you mention in your letter is distinctly an effort to claim for a corporation, all of whose stock is owned by one man, the privileges of the citizen in the one direction with the immunities of the corporation added thereto, as it were; while in another direction the immunities of the citizen are claimed with the privileges of the corporation. I fancied that for a while such practice would be tolerated, and a danger; but now I am inclined to think the Courts are fully alive to the danger. The principle that the supervision of a corporation by the Courts is not for the benefit of the stockholders, but because a corporation, by virtue of its being, is a public functionary, may be held as established in this country."

It appears to me that any educated person can see the bearing of this opinion on the matters discussed at the Denver meeting of the American Gaslight Association. Another correspondent distinctly affirms the principle involved, and declares it his judgment that the interests which purchased the Housatonic Dam privileges will yet have to reckon with the State in a way their lawyers have not foreseen. He also speaks of the "attempt to claim the privilege of citizenship for shareholders in corporations." So the contest between Collectivism and Individualism shows new forms under new skies.

Trade Unionism in England.

I was discussing the raid of the Western Gas Construction Company on the English Market with an agent of a German Gas Construction concern at dinner the other day. I maintained it amounted to nothing more than a New York house getting a contract in Montreal or a Canadian house at Minneapolis; and he did not agree with me. He expressed the following startling opinion: "The English have permitted the battle to go by default between the workmen and the owners; the owners pay the taxes, and the Trade Unions run the works. The result is the English cannot expand. Why did they buy bridges in this country and locomotives to send out to Africa? Because they were better? By no means; they were not so good. It was because the factories in England were full. This is nonsense. No manufactory is ever full if it is growing; but England is not growing industrially, only commercially. English merchants must have goods to sell and freights to carry. They used to carry English goods, because English factories were growing bigger and bigger, and the workmen worked harder and harder, and became daily more skilful. Then came the Unions; and now England is becoming like China—they care more for the tradition of yesterday than the demand of to-morrow." Then we began to discuss advances in gas making; and he said: "Why did the English let someone else develop the enriched producer gas we all use now? They knew before anyone else that the right way to make gas was 'the mixed method,' yet London is only just beginning to use it; and they do it as an American system or a German system, while but for their paresis you Americans and we Germans would be using an English system." I suggested that the system was not perfect, and its perfection might come from England. "Never," he said, "the English know the need, but they have not the will to improve. It is their workmen who are at fault. They suffer from paretic dementia, and have two delusions. They think they know trade interests better than their masters, and that they are indispensable to the world. They will wake up some time, and find, as they did in France, that the deluge has come, not after them, but on them; and then they will wake to fear, to suffer, and to die—not to fight, to conquer, and to enjoy. A Trade Unionist workman is the foe of all progress; he is an ox who has the maggots, and breaks his yoke, and gores his owner who feeds him." This tirade so nearly met my version of what I learned from reading

and from my sojourn in Birmingham, that I was quite startled. "They be our friends who warn us of our faults and of impending danger."

THE ELECTROLYSIS CASES.

The relation of the injuries to the pipes of gas companies by the electric light and power companies' neglect of the obvious remedy, seems to be well established; and we shall probably hear no more about the principle. Only the amount of damage in any special case will remain for discussion. But one thing is still unsettled. How are the damages already done to be estimated? Granted that in future no one is to use the pipes of a water supply or a gas company as a back-track for current, will that bring the mischief to an end? Wherever the single-wire system is used, and the current makes its way through the earth as best it can, we all know that electrolysis is a conclusion fully determined; but when the very best possible precautions are taken, what then? Will it be held by the Courts that, these precautions being taken, the electric companies are no longer responsible for results, or will it be held otherwise?

Experiments are being made in New York which go to show that if the simple fact of destruction without some such limit to liability is laid down, the companies will have a world of trouble on their hands. It is also shown that the superintendent who takes it for granted that these law-required devices are to abolish the danger and the damage, will wake up some morning with a bad half-hour before him. Experiments have been made along the lines of the metropolitan metals, which show that induced currents of considerable power and volume are running in the water-mains; and if any precaution can be sufficient, surely theirs should be.

TECHNICAL RECORD.

IRISH ASSOCIATION OF GAS MANAGERS.

The Annual Meeting in Dublin.

At the close of the discussion on Mr. Tully's paper, as reported in the "JOURNAL" last week, p. 452,

Mr. S. B. LANGLANDS (Coleraine) read the following paper:—

THE RELATION OF CONSUMERS TO THE GAS MANAGER.

My subject is a meditative one—a subject we managers must nowadays take to *avizandum*, to put it in legal Scots, and having done so, must be up and doing. The days are gone from us in which our sphere of labour was in the precincts of our gas-works—those days in which our consumers were not wooed and won from us by strong rivals. Do not mistake my intentions, and say "Here's a young fellow with a pessimistic bias come to throw bombshells among us to our disturbing," for my intentions are good, if my method is *outré*. What I want to be at to-day is to give my ideas, and to get yours, as to the best means of strengthening the relationship existing between our consumers and ourselves. Even at this late day, I find a deal of ignorance exists about our commodity; and at the outset this must be tackled. You will still get intelligent folks who think "As big a liar as a gas-meter" is a proverb, and others who enlarge, half in fun but wholly in earnest, on the "fanners" at the gas-works which mix God's cheap air with the gas, to the increase of gas bills, and so on. So I say make ours no secret process. When and where you get an opportunity, illumine the darkness of consumers' minds as well as the interior of their dwellings. Show them over your works, show the beautiful mechanism of meters, and hide as little as possible.

One of my ideas is that, where it is practical, as it is in most Irish cases, the manager should do a survey of the meters himself at least once a year, as not only does it ensure correctness of surveying, but it also allows our customers a chance of telling of defects in lights, in cookers, in fires, or in engines. And how sweetly simple the remedies are in a hundred-and-one cases. For instance, you will meet people who boast of using the same burners for ten years. You tell them burners should be renewed every six months, and there and then fit in a new one alongside an old one. They then find out the true reason why their light was not so good as that in the manager's own house, and that he does not manufacture a special quality of gas for himself. Incandescent lights are found in a shameful condition in many cases—pieces of old mantle clogging up the bunsen burner, deposits of carbon on the mantles from the pilot lights, and old mantles that have done duty for too long a period. Yet how easy it is to take these burners apart for cleaning, and how simple to lower the gas and burn off the carbon, and then lessen the size of the pilot flame. How fondly do our customers cling to globes with 1½-inch openings at the base and 3-inch at the top; the globe thickly frosted, and an opal Diana and her dogs etched thereon. A wide gallery and a clear wide-bottomed globe being fitted, the abominable flickering and obscuration are done away with; and how pleased your consumer is—that is, if he hankers not after false gods and goddesses, from which no light comes. Venus and Diana are all very well in their own place.

Low pressure and the reverse are common sources of trouble; and here again the gas manager can "come, see, and conquer." The accumulations and deposits of years in the pipes and brackets are often the cause of defects in pressure, although plumbers sin constantly by fitting small pipes in contract jobs. To unscrew a bracket and insert a wire is a small matter, but often effective. Excess of pressure can in most cases be regulated from the stop-cock at the meter; but if that seems too easy a remedy in the consumer's eyes, a governor or governor burner can be offered as a perfect cure.

If a person wants a gas-cooker, and wants advice in getting one, find out his needs; do not sell one because it is in stock. Ask how many there are to cook for; find out if they want a big oven, or if the oven is of minor importance; find out if they would like to pay cash, and if your company do not hire, and your customer does not find it convenient to pay it all at once, take the price in two payments. What I would like is that, as far as possible, we gain our consumers' confidence and trust by our treatment. If it should be a gas-iron, or a gas-fire, or a gas-geyser, do not be afraid to say that a gas-iron sometimes emits a smell of burned gas, and that care must be taken when lighting to heat it up slowly. Tell them gas-fires used night and day—that is, used recklessly—mean big bills, but used carefully are all right. Recommend them for drawing-rooms, bedrooms, or any room not in constant use. You may say that a dish of water placed near a gas-fire, and allowed to evaporate slowly, makes the atmosphere of the room more pleasant. In the case of a gas-geyser, explain why the water must first be turned on, and see that the products of combustion are properly taken away.

Bakeries, cafés, hotels, and like places can be made sources of revenue; and if once the cooking is done by gas, it is our own fault if they go back to older systems. Many bakers' hot plates and hot ovens are made in amateurish ways, by firms who know nothing of the principles of construction necessary in gas-fired plates and ovens. I have come across many of these; and on inquiring as to the maker's name, found that it was quite an unknown one. These plates and ovens are made to sell, not to cook or heat; and when an article by a good maker has been substituted on trial, I find it easy work getting, not one article, but many, adopted in such places.

The advice and assistance we can give to those using, or about to use, gas-engines is extensive, more especially in towns where there is no engineering firm. It may be only in the regulation of the gas and air supply, or the ignition tubes may be defective; yet if the users have to send out of town for little things like these, they are likely to become disgusted, and return to steam. The mistake made by sellers of gas-engines is that they invariably state that such an engine needs no attention; and this is too literally believed by purchasers. A gas-engine does require attention; and I imagine it would benefit us in our business if we explained the working of these engines to our customer or his factotum, who gives a "look in at the engine" now and then.

I will only touch on one other point ere I close—that is, in regard to meters. First of all, I like when my consumers can read the index of their meters, and in public works of any size I advise them to keep a weekly or a fortnightly record of their consumption. The suggestion has been largely adopted in my town, and some even go the length of keeping a day-to-day record. When a complaint is made that an account is more than usual without any apparent cause, I get the customer to read the single-foot dial, or wheel (say) at 9 in the morning, turn on the gas at the meter and abstain from using until (say) 3 in the afternoon, when the meter is again taken, and any escapes detected. Or I myself test for escapes with a pressure gauge. If the consumer be an angry man who makes a noise and insists that his meter is at fault, the best means is to arrange with him to have it tested at one of the meter-testing stations—he paying all expenses if the meter is found correct, the company or corporation paying if found wrong, and making restitution. In the case of wet meters, never allow your fixed times for watering to go past, as nothing is more annoying than a "light that fails."

These, gentlemen, are a few of my ideas on our relationship to our consumers; and I shall be glad if a spirited discussion be the outcome of the recital of them. Perhaps if I tell you what my favourite quotation is, you will get the keynote to my thoughts.

> One who never turned his back but marched breast forward;
> Never doubted clouds would break;
> Never dreamed though right were worsted
> Wrong would triumph.
> Held, we fall to rise, are baffled to fight better.
> Sleep to wake.

Discussion.

Mr. T. HANDS (Enniskillen) said he thought that of all the subjects which had come before them, this was one of the most important. He believed gas companies often stood in their own light in letting "jerry" plumbers and gas-fitters do work for their customers. He was speaking from practical experience. In the works of which he was in charge, they used not to keep any gas-fitter; and the consequence was that, as a rule, the cheapest ironmonger got the job and did the work—well, he would not call it work, for he never saw such a mess in all his life, in some places. The lights were constantly jumping; and the Gas Company always got the blame. He came to the conclusion that he must tackle the subject in earnest. They were then selling gas at 6s. 6d. per 1000 cubic feet, and the shareholders were not getting any dividend, while the consumption of gas was decreasing. He engaged a gas-fitter, and took the work in hand. The whole trade was up in arms against him, and sent a letter to his Directors, stating that if the thing were allowed to go on, they should cease to be their

friends. His Directors asked him what they were to do with the letter; and he advised them to treat it with contempt, as it should be. He undertook the work all through, from the holder to the burner; and the result was that at one stroke they lowered the price of gas 1s. 6d. for private lighting and 2s. 6d. for engines and cookers. They had overhauled their works, and were now paying 5 per cent. dividend. The consumption had more than doubled in ten years. This was the result of attending to the gas supply themselves, from the meter to the burner. Of course, they had opposition from the plumbers; but this need not cause trouble. They were working to keep gas to the front; and, if they did this, he did not think they need be afraid of electric light or acetylene stamping them out, which they had been threatened with again and again. When a customer said he was going to use acetylene, he (Mr. Hands) would tell him the cost of the two gases, and let him think the subject out for himself; and he had never lost a customer in that way. He was thankful to Mr. Langlands for bringing the matter forward. He thought gas managers should never be backward in going to their customers and offering to do anything they could for them. If there was any way in which they could help them, let them do so.

Mr. S. A. Scrivener (Dublin) said it might interest the members to have some little idea of what was being done in Dublin. They were probably aware that they had gone in very largely for showing everything of the latest in the way of using gas. They had appointed a lady to investigate complaints, which often arose from want of knowledge. She would go and see what was being done with a cooker, and would tell parties how it should be worked; and the result was that they were pleased. By following up each particular case, and by patiently showing customers where they were wrong, they enabled them to point out mistakes to their friends, because they were always talking about such things. He thought it was better for them to go out of their way and seek complaints, because if a man complained it was because he was not getting satisfaction; and if he did not, he went on in a dissatisfied way. But if he made his complaint known, they could deal with it, and render him and themselves good service.

Mr. T. Frizelle (Holywood) said the subject before them was one which touched all the members; and Mr. Langlands deserved the thanks of the Association for bringing it forward. He had headed his paper "The Relation of Consumers to the Gas Manager." A very good paper could be written on "The Relation of the Gas Manager to the Consumers," because he found, taking his customers generally, that it was not hard for them sometimes to irritate the gas manager, and also that it paid well to be courteous to every customer. This was a point Mr. Langlands had not touched upon—courtesy to every person he met. Put a gas manager in the same position as the manager of a grocery concern; none of their wives would deal at such a place if they got a short answer from its manager. This applied equally to gas people. If ever there was a time when a gas manager could afford to be short with a customer—he did not say there was—that time was past. He found that courtesy paid with consumers, and also that it paid to be a little out of pocket. Let them give a customer a burner, as Mr. Langlands had pointed out, or send a man to clean out gas-brackets, and superintend generally the branches and fittings, and also the cookers. He would suggest that it might be a very good thing to have Mr. Langlands' contribution printed in local newspapers so as to get it distributed among consumers.

Mr. J. G. Tooms (Waterford) said he must agree to a great extent with Mr. Langlands, and also with the members who had so far spoken in the discussion. There was no doubt that the gas manager, and more especially the one who had charge of small works, of which they had so many in Ireland, could, by application to business, on the principles enunciated in the paper, do great service to himself and the public generally. At places such as Waterford, the manager did not come into contact with his consumers so much as the managers of small works. He was hoping, however, that they would be able to contract for the fitting up of incandescent burners in his city. They attended to all consumers' complaints free of charge, and were glad to get them; and they gave advice to consumers as to what to do.

Mr. H. Kirkham (New Ross) said he could not altogether agree with the paper, although he did so to a certain extent; but there was such a thing as making themselves too cheap. He believed in being courteous, and in doing what they could—everything within reason—for their customers. He wanted to be very courteous to a good consumer they had, one who was rather an important man; in fact, he went out of his way to be courteous to him. In all small towns they would find that there was a clique against the gas company. The gentleman in question started an electric light scare, but it did not come off; and when he found that he could not work the electric light business, he tried acetylene. He wanted an acetylene company to light the town. He found he had not the following he expected, and he thought he would have a little "look in" on his own account. He had his private house fitted with acetylene plant. This was no loss to the Gas Company in any sense, because he lived outside the town, and his private house was not supplied with gas. But during the time the plant was being fitted up, the man who was doing the work came to him (Mr. Kirkham) several times for fittings; and he let him have them. The gentleman recently came to him and said he had a leak in his billiard-room. He did not know what had become of the acetylene, but he believed the gentleman would eventually substitute oil for it. Something had gone wrong with the acetylene. There was no doubt that if a consumer could read his meter, it would be a great help to them.

Professor Macadam (Edinburgh) said he was sure they were all deeply indebted to Mr. Langlands for his paper. He was in the position of a consumer, and he knew he generally received very great courtesy from gas managers. But probably it was sometimes a little difficult to recollect that gas managers were human. Something went wrong with the fittings, and it was the natural thing, on the consumer's part, to blame the gas manager, rightly or wrongly. There was one point in regard to gas cooking-stoves to which he did not think Mr. Langlands had referred. He suspected it would pay gas managers very well if they could control the gas supply beyond the meter—at least, if they could fix the necessary pipes for cookers. His experience was (not so much in his own house, for he looked after it there, but elsewhere) that there were complaints about cookers not working properly; and he suspected that gas companies were often to blame for putting in too small a pipe. There was another point which Mr. Langlands might enforce—viz., that meat roasted in a gas-oven cut up very much better than that roasted in another oven; in other words, there was actually a greater total amount by weight of roast beef turned out, and it cut up and ate better. He thought this was a strong point when referring to cooking by gas. He was speaking from the restaurant point of view. A still further point was with regard to incandescent mantles, which brought out the need for the education of the consumers. They had heard a great deal about the education of gas directors; but let them look at the infinitely greater trouble they were now taking in hand. Of necessity he had incandescent burners in his room; and he could not make out that they were cheap. The repairs were very considerable. The number of new mantles required was large, and this meant heavy expense. Then they required delicate handling. The majority of their houses were not very strong, and consequently were liable to have a good deal of spring, which told very much against the incandescent burner. He did not think there was any advantage in trying to enforce the point that there was pecuniary saving in the use of incandescent mantles; but there certainly was a better light obtained from them for a smaller consumption of gas. Generally, he thought, it was more agreeable; but he would not put it that much money was saved. One gentleman spoke of acetylene going the way of all plant. If he went to the North of England, he would find railway stations there most successfully lighted by acetylene gas, and he would never think of acetylene going to the wall. He (Professor Macadam) quite agreed that if it was a case of acetylene gas against coal gas, the latter would hold its own; but where it came to be a case of installing a small coal or oil-gas plant against acetylene gas plant, the acetylene would usually commend itself.

Mr. A. Mackenzie (Edinburgh) remarked, with regard to the lighting of railway stations by acetylene gas, that one of the best-lighted stations he had ever seen was that at Kildare.

Mr. J. Richmond (Kilkenny) said he could not differ or detract from anything Mr. Langlands had stated. He had brought forward a practical paper, on a subject which was well worth the consideration of gas managers. It was of advantage that a manager should come into contact with the consumers as often as possible. Professor Macadam had remarked that one of the great things they had to undertake was the education of consumers. By coming into contact with them they were educating them to a great extent, and especially in the use of incandescent burners. Many who used these burners knew nothing about the way that they worked; but, by taking a little trouble, managers could educate them—showing them their construction, and the principle on which combustion took place—thereby enabling consumers to keep their burners in good condition themselves. Professor Macadam, in his remarks about the oscillation of buildings, seemed to forget that there were such appliances as anti-vibration springs, which prevented the deterioration of mantles.

Mr. J. Lyne (Wexford) was sorry there was so little in the paper from which he could differ; but he should like to know from the author whether his Corporation supplied all the fittings themselves, or trusted people outside to do this for them, because to his mind there was a good deal in that point. If they trusted to outsiders to do fittings and so forth, they were certain to have complaints without end. He thought gas companies should take such things into their own hands. There would be less cause for consumers complaining if this were done. He did not think Mr. Langlands had advocated very strongly the use of dry meters; they all knew that wet meters were by far the more reliable instruments. There was much less loss of gas with them, and they caused a great deal less complaint from consumers. He regretted Mr. Langlands had not dealt with this point. He quite agreed with what Professor Macadam had said about the cost. He thought if they took the cost of the mantles and the attention they required, there was no great economy. There was, of course, a saving in this way—that they obtained a large increase of light. While on the subject of mantles, he might say he regarded it as a great wrong to gas producers, as well as to gas consumers, that they should be obliged to pay so high a price for mantles, when they were being sold so cheap on the Continent. There they could get mantles of German make—if they could only use them—at 1d. apiece; whereas the Welsbach Company insisted upon charging 7½d. each for them. He thought that there was not the smallest chance of acetylene competing with coal gas, where this could be had at a reasonable price.

The Hon. Secretary (Mr. J. Whimster, of Armagh) said the author of the paper had opened up a most interesting subject for the consideration of the members. Mr. Langlands thought it would be a good thing if consumers were able to read their own meters. He (Mr. Whimster) could heartily endorse that view. He had done his very best to try to educate a great many of his consumers so that they might read their own meters; and he had found it to be most advantageous. When he went to Armagh, he had consumers coming to him and saying the gas people charged just what they pleased. He advised them to read their meters. He induced some of the consumers to keep a pass-book, and he now found they would be waiting with it for the inspector; and they were able to see that he was right. Some of the largest consumers had been led to read their meters every Monday morning; and since then there had been no grumbling. One man who had been taught to read his meter came one day and said the meter was not recording. Had he not been able to read it, this defect would not have been discovered till the end of the winter quarter. The meter was repaired at once, and there was no further trouble. Mr. Langlands had said that he thought a gas manager should himself go round once a year and take the meters. As to this, he had to say the managers in Ireland were trying to get relieved of this duty. He himself considered it was not right that a manager should take the meters, for the reason that if they had an inspector or a gasfitter taking the indices, and a complaint arose, the manager was there to appeal to. But if the manager had taken the index himself, who was there to check it? This was one of the things which gave rise to the complaints about gas companies charging what they liked. Of course, as to attending to complaints, there were complaints and complaints. There were normal grumblers among his consumers; and he had people who did not grumble, at which he had wondered many a time. He always tried to do the best he could with both classes, and in the easiest way.

Mr. G. Cummings (Ballymoney) said he had heard so much that his interest—he might say his enthusiasm—on the subject before them was roused. He had never seen a bunsen burner properly connected with an incandescent mantle until about four months ago, when he saw a new burner introduced by a traveller. That was the first he had ever seen made according to the teachings he received in his youth, as to how such a burner should be made. The delivery of the gas was usually too high for the air-holes round the side of the tube. With regard to meters, he was very glad Mr. Whimster had met with so conscientious a consumer as the one to whom he had referred. He (Mr. Cummings) would relate a little experience of his own. A consumer had found fault several times with his meter, and he (Mr. Cummings) told him he could do nothing. He refused at last to test the meter unless the consumer came to the station while the test was going on. He came and was satisfied. Then the consumer had a second meter put in, to supply a portion of his premises which he had let to his sons. Six months afterwards, he wished to have the first meter tested. This was done, and it was found not to have moved. When the consumer was sent for and told this, it turned out that he wanted to ascertain whether he (Mr. Cummings) would test it aright. They had consumers who worked honestly; but they had others who tried them in every shape and form.

Mr. Langlands, in reply, said he thought that, perhaps the best thanks he had received for his paper was the discussion that had taken place upon it. Mr. Hands had backed up what he had said; and he had nothing to add in answer to him. Mr. Frizelle spoke about courtesy. He (Mr. Langlands) took it that courtesy was the natural attribute of every Irishman; and he did not think it worth his while to dwell upon this subject. Professor Macadam talked about the cooking of meat—a very useful remark to many of them. As to acetylene gas, he had never found it to be a rival of coal gas. There was a very large acetylene plant near him, and he assisted the gentleman who worked it, in the matter of purification and so forth. With respect to incandescent burners, he tried as much as possible to get them on to a bracket on the wall, to prevent vibration. Mr. Lyne had asked him about the fittings in the consumers' houses. His Corporation, he was afraid, would demur if he wanted to go into the gas-fitting business so thoroughly. He would like to do it, but they did not. As regarded wet and dry meters, everyone, he thought, would admit that the wet meter, when working properly, was *the* meter. But where there was a tendency to the deposition of water in the pipes, a dry meter should by all means be fixed. He concluded by thanking the members very much for the attention they had bestowed upon his paper.

Mr. Richmond proposed a vote of thanks to Mr. Langlands for his paper.

Mr. T. Whimster (Omagh) seconded the motion, and it was carried unanimously.

The Lecture.

At a rather late hour, Professor Ivison Macadam, of Edinburgh, delivered his lecture on

COALS: THEIR COMPOSITION, PROPERTIES, AND USES.

Mr. President and Gentlemen,—The subject which I have selected for this lecture is that of "Coals: Their Composition, Properties, and Uses." The formation of the mineral known as coal is now generally acknowledged to have been due to deposits of vegetable matter which were formed during a geological period when the climate of this country was much more tropical than it is at present, and vegetation was therefore much more luxuriant than it now is. Some coal deposits, however, did not require a tropical climate, as is shown by the large recent deposits of peat. In some cases the old forests would appear to have been overwhelmed by water, with the consequent admixture of more or less sand and clay; resulting in a higher percentage of ash in the present-day coals.

That coals are of vegetable origin no one can doubt who has examined the various classes, and noted the, in many cases, perfectly preserved fossiliferous ferns, bark, fruits, and even tree trunks, which are found so frequently on breaking a mass of coal. No doubt fish remains are also found in some coals, but these can be readily accounted for during the period when the coals were being covered up by lacustrine deposits. Coal beds are found in all sedimentary formations, and are therefore of all geological ages; but our larger supplies are obtained from the horizon known as the carboniferous rocks. The various ages of the coal strata are shown by the various classes of coal employed for industrial purposes.

When wood matter is buried, the composition is gradually altered, with the liberation of hydrogen, marsh gas, and carbonic anhydride. This process goes on rapidly when the vegetable matter is covered with water, and the name "marsh gas" indicates to us this well-known change. If the leaves at the bottom of a pool of water are stirred, gas is given off, and if a match is applied, this readily burns, from the presence of hydrogen and methane or marsh gas. No doubt, also, you have all seen very considerable accumulations of gas under a coating of ice formed on the surface of water in shallow pools containing much vegetable matter. If the ice above these accumulations is bored, the pent-up gas escapes and may be lighted. The gas is produced by the first stage in the gradual transformation of the vegetable matter into a coal. Peat, in fact, is our youngest coal formation. Fire-damp, so often found in coal pits, is no doubt also often simply the gas produced in a similar manner, but after the coal has been covered up. Gas accumulations are, however, also doubtless frequently due to the distillation of coal by internal heat; and the coal surrounding the pockets in which fire-damp is found often bear evidence of "burning" or heating.

Some carboniferous deposits it is difficult to prove as having been produced by the methods referred to. This is the case especially with that curious class of minerals known as bogheads or torbanites. This mineral, first found in a basin at Boghead, in Scotland, and at one time considered to be unique to that locality, is now known to exist in many parts of the globe. This mineral—our richest of all gas-making materials—is essentially different from ordinary coal; and yet tree stems are found in the layers more perfectly preserved than in any coal formation. One well-known Scottish geologist ascribed the origin of the substance to clay impregnated with oil; and he stated that, given the clay and oil and sufficient pressure, he would be prepared to make the material artificially. Be this as it may, the mineral is the most valuable of the gas-making fuels. The analyses of the substance (one sample from Boghead and one from Australia) fully bear out this statement. It is, however, purely a gas or oil producer, and not of great value as a direct heat-giver.

The shales may be ascribed to plant life grown either in muddy estuaries or liable to be flooded by dirty river waters. They are in many instances highly fossiliferous, and in all cases give high percentages of ash or mineral matter. They are useful gas-making materials; but the cokes left by them are practically useless, and the excessive ash, except in very exceptional cases, proves a barrier to their extensive use. They often contain abundant fish remains, and then give excess of volatile sulphur compounds to the gas produced by their carbonization.

The gradual alteration of vegetable matter is well noted in peat, brown coals or lignite, bituminous or pit coal, and anthracite. The brown coals or lignites are found in newer formations than the true carboniferous. They are widely distributed; but the largest deposits appear to be those in Germany and in Australia. The fibrous wood structure is often most perfectly retained, though, in some cases, little true vegetable form is shown. When freshly cut, the material contains much moisture—often as high as 45 to 48 per cent. When air-dried, the mineral shrinks and cracks. These coals are mostly employed as fuels; but from the great loss due to the evaporation of the contained water, they do not give great heat. Ordinary bituminous or pit coals vary greatly, some being "soft" and readily broken, others "hard" and tough; some readily set fire to, others difficult to burn. Possibly the "soft" coals are the newer; but here again the varying conditions under which the coal was formed must have played a most important part.

The chemical composition of coal also varies greatly. The anthracites are generally considered the oldest of the coals, and the elimination of hydrogen and oxygen is therefore more perfect; and yet the proportions vary greatly. The following table gives a general idea of these variations in chemical composition:—

	Anthracite. Per Cent.	Cannel. Per Cent.	Splint. Per Cent.
Carbon	70 to 96	55 to 84	75 to 85
Hydrogen	½ to 2	3 to 8	4 to 6
Oxygen	½ to 1	2 to 5	4 to 6

Sulphur varies greatly, not only in amount, but in the form in which it is present. Sometimes it is found as pyrites sulphide (of iron), and is then frequently visible as bright spangles or plates,

sometimes as sulphates; and (especially when fish remains are present) sometimes as perfectly non-visible organic compounds.

The composition and actual analysis of coal must, of necessity, be of great interest to you, for without an analysis it is impossible to check the results of your working. I have, therefore, thought it might be of interest to you to consider for a few moments the form of analysis, and to go over, without great detail, some of the more important points. Necessarily, the details of an analysis must vary greatly with the special purpose for which it is desired. If the coal is to be employed for heating or steam raising, the details required will differ from those necessary if the mineral is for making lighting gas, and will also differ from those needed if the coal is to be used for the production of carburetted water gas, water gas, or producer gas. For heating purposes or for steam raising, not only should the ordinary proximate analysis be given, but also the ultimate analysis; for from the latter may be calculated the calorific value. For producer or water gas the ultimate analysis is also valuable; for the quantity of gas largely depends upon the carbon present. For furnace purposes, the presence of much sulphur, and the condition in which that body is present, will be interesting, as showing the liability or otherwise to clinker. For gas-making purposes, the volatile matter, the form of the coke, and also its composition, along with the illuminating power of the gas, will be required. In the last case, more especially, the amount and quality of the gas should be the result of a practical trial under gas-works conditions. This does not of necessity mean the carbonization of large quantities; for a small works, in which only minimum charges are used, if properly operated, will give as reliable results as the working of tons of material.

I have given the ultimate analyses of three samples of coals; but I do not attempt to explain how the figures are arrived at:—

	Splint (Lothians).	Coal (Steam).	Anthracite (Fife).
Carbon	74·25	77·01	88·32
Hydrogen	5·54	6·27	0·11
Nitrogen	0·78	1·44	0·08
Oxygen	5·77	6·16	0·04
Sulphur	0·36	0·12	1·37
Ash	3·43	3·51	6·75
Water	9·87	5·49	3·33
	100·00	100·00	100·00
Calorific power, B.T.U.	12,915	13,600	12,577

In calculating the heating power of coals or coke, the standard used is the "calorie," which represents the heat required to raise one kilogramme of water from 4° to 5° C. In this country, however, it is more usual to employ what is known as the "British thermal unit," usually expressed as "B.T.U.," which represents the heat required to raise 1 lb. of water 1° Fahr.; the water being taken at its maximum density (39·1°). To reduce calories per kilogramme to B.T.U. per pound, multiply by 9 and divide by 5. The calorific powers have been very carefully estimated, and the results are as follows:—

1 kilo. of carbon completely burned produces 8,140 calories.
1 ,, of hydrogen ,, ,, ,, 34,500 ,,
1 ,, of sulphur ,, ,, ,, 2,220 ,,

Taking the British standard, the following may be accepted as sufficiently correct:—

Carbon . . . . . 14,220 B.T.U.
Hydrogen . . . . . 60,854 ,,

In calculating the calorific value of a coal, all that requires to be done is to multiply the percentage of carbon shown on analysis by 14,220, and the percentage of hydrogen by 60,854. On adding these two results together, the total possible B.T.U.'s are obtained. A correction, however, still requires to be made for the moisture present in the coal, and for the water produced during combustion, which, in the process of being converted into steam, absorb a certain amount of heat which is not available for actual steam raising, but has become, for the time being, "latent." To find the amount of hydrogen in the coal to be deducted from the total hydrogen on account of its being converted into water during combustion, all that requires to be done is to divide the oxygen by 8, and deduct the amount so found from the total hydrogen before multiplying for the calorific value.

After obtaining the totals of the carbon and hydrogen values, the deduction is made for loss of heat through the steam. To find this figure, multiply by 9 the hydrogen found on an analysis of the coal, and the result will be the amount of water produced by the hydrogen on combustion. Add to this figure the moisture found in the coal; and the result is the total water to be converted into steam in the course of combustion. The amount of heat absorbed by each unit of water during conversion into steam is 964·6 B.T.U. Thus the total water multiplied by this figure gives the total non-available heat units lost during combustion.

Let us take, as an example, the second of the analyses in the table. The calculations necessary are—

Carbon, 77·01 per cent. × 14,220		1,095,082
Hydrogen, 6·27 per cent., less hydrogen for oxygen (oxygen, 6·16 per cent. ÷ 8 = 0·77) 6·27 − 0·77 = 5·50 × 60,854		334,697
		1,429,779
Deduct latent heat of steam. 6·27 × 9	56·43	
Moisture	5·49	
Total water	61·92 × 964·6	59,728
Total B.T.U. from 100 lbs. of coal		1,360,051
B.T.U. from 1 lb.		13,600

This heat will be equal to that required for converting 14·09 lbs. of boiling water into steam, 13,600 ÷ 964·6 = 14·09.

*Heating Value of Gases.**

Gas.	1 Kilo. Evolves on Complete Combustion— Calories.	B.T.U. per Lb.	B.T.U. per Cub. Ft. at 0°C. and 760 Mm. (32°F. & 30 In.Bar.)
Hydrogen (H)	34,500	62,100	348
Carbonic oxide (CO)	2,487	4,476	349
Marsh gas (CH_4)	13,245	23,851	1,065
Acetylene (C_2H_2)	11,925	21,465	1,555
Ethylene, olefiant gas (C_2H_4)	11,900	21,440	1,673
Ethane (C_2H_6)	12,350	22,230	1,858
Propane (C_3H_8)	12,028	21,650	2,654
Propylene (C_3H_6)	11,900	21,420	2,509
Butane (C_4H_{10})	11,850	21,330	3,447
Pentane (C_5H_{12})	11,770	21,186	4,250
Sextane (C_6H_{14})	11,620	20,916	5,012
Benzene (C_6H_6)	10,250	18,450	4,010
Naphthalene ($C_{10}H_8$)	9,620	17,316	6,176

[* "Engineering Chemistry," Stillman, p. 259.]

When calculating the heating value of a gas from the volumetric results of the analysis, it is more convenient if first the calories per kilogramme are calculated into heat units per volume. In this country, it is usual to state the results in B.T.U. per cubic foot of the gas. This is easily done if the calories per kilogramme are known; for the latter multiplied by 9 and the result divided by 5, as already explained, gives the British thermal units per pound. This last divided by the number of cubic feet of gas per pound gives the B.T.U. per cubic foot. In calculating the cubic feet of a gas contained in 1 lb. weight of the coal, we require to bear in mind that the pound contains 453·59 grammes, that the metre is 39·37 inches long, and that the cubic foot contains 1728 cubic inches. The calculation then resolves itself into: $1728 \div (3{\cdot}937)^3 = 28{\cdot}317$ litres per cubic foot. To now obtain the B.T.U. per cubic foot, the calculation becomes:

$$\text{calories per kilo.} \frac{9 \times 28{\cdot}317}{5 \times 453{\cdot}59} \times \text{weight of 1 litre of gas in grammes}$$

= B.T.U. per cubic foot.

We now require to know the weight of a litre of a gas in grammes; and although this is not at all difficult, yet possibly a little explanation may not come amiss to those who have not much practice in the solution of chemical problems. All elementary or simple substances can be resolved into ultimate particles, called atoms. These never exist for any length of time free, but group themselves into what are known as molecules. The molecule of a simple body contains generally two atoms of an exactly similar nature; while the molecule of a compound body is built up of dissimilar atoms. Thus the molecule of hydrogen contains two atoms of hydrogen; while the molecule of methane or marsh gas contains one atom of carbon joined to four atoms of hydrogen, and the molecule of olefiant gas (ethylene or heavy carburetted hydrogen) contains two atoms of carbon united to four atoms of hydrogen. The molecule of a compound may therefore contain more than two atoms. The atoms of the elementary or simple substances would appear to be of the same size; but they differ in weight. Hydrogen is the lightest substance known; and all other atoms are therefore heavier than the hydrogen atom. Thus the atom of oxygen, though of the same size as the atom of hydrogen, is 16 times heavier; the atom of sulphur, 32 times greater in weight; and the atom of nitrogen, 14 times heavier than the atom of hydrogen. It further follows that if atoms are of the same size, they will always occupy the same space; and as the molecules of a simple gas contain two atoms each, they also will occupy similar volumes. If, therefore, we take the same volume of any number of simple gases, being careful to measure them at the same temperature and pressure, we are always sure that, whatever may be the number of molecules present in one case, it will be the same for all others. Suppose we take a litre of hydrogen gas at normal temperature and pressure, and weigh it, we get a result which, when multiplied by 14, will give the weight of a litre of nitrogen gas; when multiplied by 16, the weight of a litre of oxygen gas; when multiplied by 12, the weight of a litre of carbon vapour; and so on for the remainder of the simple bodies. The figures will be as follows:—

Weight of one litre of—
Hydrogen . . . . . 0·0896 grammes.
Oxygen (0·0896 × 16) . . . . . 1·4336 ,,
Nitrogen (0·0896 × 14) . . . . . 1·2544 ,,
Carbon (0·0896 × 12) . . . . . 1·0752 ,,
Sulphur (0·0896 × 32) . . . . . 2·8672 ,,

In the above calculations, it will be noticed that the figures used are half the weight of the molecule, for if the atom of oxygen weighs 16 times more than that of hydrogen the molecule (2 atoms) will weigh 32 times, which divided by 2 gives 16, which is similar to the weight of an atom of oxygen. This, however, does not alter the law for obtaining the weight of a litre of a gas—viz., to multiply the weight of the litre of hydrogen by half the molecular weight of the gas.

In the case of compounds, the same law holds good; but here we may have more than two atoms in the molecule. The molecule of marsh gas or methane (CH_4) contains one atom of carbon and four atoms of hydrogen; and the weight of the molecule will therefore be found by adding together the weights of one atom of carbon and four atoms of hydrogen, thus—

1 atom of carbon 12
4 atoms of hydrogen 4
Molecular weight 16
Half molecular weight 8

The weight of a litre of marsh gas will, therefore, be eight times that of hydrogen. We thus obtain the following figures:—

Weight of one litre of—	Grammes.
Marsh gas (CH_4)	12+ 4= 16÷2= 8×0·0826=0·7168
Carbonic oxide (CO)	12+16= 28÷2=14×0·0896=1·2544
,, anhydride ,, acid (CO_2)	12+32= 44÷2=22×0·0896=1·9712
Olefiant gas (C_2H_4)	24+ 4= 28÷2=14×0·0896=1·2544
Ethane (C_2H_6)	24+ 6= 30÷2=15×0·0896=1·3440
Propane (C_3H_8)	36+ 8= 44÷2=22×0·0896=1·9712
Benzene (C_6H_6)	72+ 6= 78÷2=39×0·0896=3·4944
Naphthalene ($C_{10}H_8$)	120+ 8=128÷2=64×0·0896=5·7344

The formula given above may, for all practical purposes, be considered to resolve itself into—

Calories per kilo. × half molecular weight × 0·01003 = B.T.U. per cubic foot.

Ordinary atmospheric air is a mechanical mixture of the two gases oxygen and nitrogen; and the actual composition may be taken as—

Oxygen	23·134 per cent. by weight,
Nitrogen	76·866 ,, ,,

The weight of the litre will, therefore, be—

23·134×16= 370·144
76·866×14= 1076·124

Weight of 100 parts = 1446·268 grammes.
Weight of 1 part = 14·462 ,,
Then 0·0896×14·462=1·295, the weight of 1 litre of air.

For gas-making qualities, the results are necessarily more complex; and the appended table gives most of the essential items. To this table I have added the partial results of several coals, so as to show their comparative composition.

Analyses of Samples of Various Coals, &c.

—	Boghead. (Torbanehill.)	Bedford Boghead.	Cannel Coal. (Lothians.)	Cannel Coal. (Fife.)	Splint. (Lothians.)	Silkstone. (English.)	Silkstone. (Scottish.)	Jewel. (Fife.)	Soft Coal. (Scottish.)	Anthracite. (Scottish.)	Lignite. (Hesse Cassel.)	Brown Coal. (German.)
Specific gravity	1224	1282·5	1227·51	1280·26	1322	1278	1287	1262·24	..	1361·72	..	..
Weight of 1 cubic foot	76	79·92 lbs.	76·49	79·78	82·38	79·64	80·00	78·66	..	84·86	..	..
Preliminary Analysis—												
Volatile matter	60·40	43·87	40·61	36·14	31·32	30·76	31·75	29·55	28·37	0·34	42·10	62·25
Fixed carbon	9·01	45·01	45·02	44·88	55·02	61·12	62·38	55·71	58·74	88 21	52·98	20·25
Ash	29·55	8·91	7·04	12·88	3·43	3·36	3·98	2·16	8·93	6·75	4 92	17·50
Sulphur	0·24	0·49	1·59	0·62	0·36	0·58	0·27	0·56	2·34	1·37	..	..
Moisture	0·80	2·44	5·74	5·48	9·87	4·18	1·62	12·02	1·62	3·33	..	..
Coke, per cent. coal	..	53·44 p.c.	52·59	58 04	58·56	64·72	66·51	58·15	68·96	..	..	..
Sulphur in volatile matter	..	..	..	..	..	..	0·12	..	1·05	..	..	..
Sulphur in coke	..	..	..	..	..	..	0 15	..	1·29	..	..	..
Ash per ton coal	..	183·45 lbs.	157·69 lbs.	288·51	76·8	75·26	..	48·38 lbs.	200·03	..	..	..
Coke ,, ,,	..	1306 ,,	1171·96 ,,	11½ cwt.	1311¾	13 cwt.	1490 lbs.	11 1/16 cwt.	1544·70	..	..	..
Sulphur (vol.) ,, ,,	..	..	..	..	..	..	..	..	23·52	..	..	..
,, (fixed) ,, ,,	..	..	..	..	..	..	..	..	28·89	..	..	..
,, (total) ,, ,,	..	..	35·61 lbs.	13·88 cwt.	8·00	12·99	..	12·54	52·41	..	..	..
Analysis of the Coke—												
Carbon	23·33	84·22	85·41	77·14	93·82	94·43	93·79	95·80	83·93	..	..	..
Hydrogen, oxygen, &c.	..	..	0·63	0·19	0 22	..	..	..	1·26	..	..	..
Sulphur	0·15	0·45	0·51	0·48	0·11	0·38	0·23	0·49	1·87	..	..	..
Ash	76·52	15·33	13·45	22·19	5·85	5·19	5·98	3·71	12·94	..	..	..
Ash, per ton coke	..	343·39 lbs.	301·29	497	131	116·25	..	83·10	289·85	..	..	..
Sulphur ,, ,,	..	10·06 ,,	11·42	10	2·46	8·51	..	10·97	41·88	..	..	..
Analysis for Gas—												
1 ton gives cubic feet	15,120	12,768 c.ft.	10,793	8866	..	11·574	11,676	8920	10,080	..	..	..
Analysis of Purified Gas.												
5 cubic feet (union burner)	44·57	30·52 c.p.	35·51 c.p.	22·06	..	18·42	15·69	15·0	12·83	..	..	..
1 cubic foot, grains of sperm	1070	732·48 grs.	852 grs.	529	..	442	376	360	327·92	..	..	..
1 ton, pounds of sperm	2311	1336·04 lbs.	1313·66	670	..	730·94	627	458·74	472 20	..	..	..
Carbon dioxide	..	0·12 p.c.	0·13	0·16	..	0 14	..	0·18	0·12	..	..	..
Carbon monoxide	..	..	..	..	..	..	..	..	9·84	..	..	..
Heavy hydrocarbons (Dr. Wallace)	..	15·42 p.c.	16·53	9·14	..	6·12	..	5·46	4·81	..	..	..

In making the photometric tests, too much care cannot be taken in the selection of the standard of light and the burner, and in checking the results against temperature and pressure. The last item seems to be frequently ignored, especially in the smaller gas-works; and the neglect of the precaution renders the working tests absolutely useless. This remark also applies to the gas passing the station meter, where the variations are of quite as much importance.

For low-quality gases of from 12 to 16 candle power, the best and most concordant results are obtained by the use of the "London" standard argand; while for higher quality gases the union burner is to be preferred. This is well seen in the following comparative tests with a gas burned with a No. 8 Bray and with the standard argand. In both cases the consumption was 5 cubic feet, and the results are fully checked for temperature and pressure:—

	Bray No. 8.	Standard Argand.
5 cubic feet equal	12·83 c.p.	.. 15·21 c.p.
= grains of sperm per cubic foot	327·92	.. 365·04
= pounds of sperm per ton of coal	472·20	.. 525·65

Time, however, will not permit of my going further into these matters. I have already trespassed too fully. I can only hope that on some future occasion we may again meet, and have an opportunity of carrying the subject to a more complete issue.

At the close of the lecture,

The Hon. Secretary said he was very sorry the members were in the position they were that day. Professor Macadam had come a long way to give them a lecture which was most interesting. Many of them would like to ask him questions, and get opinions from him; but they had not time. He hoped Professor Macadam would forgive them, and they would try to do better another time. He had shown himself to be most interested in the Association, not only by coming to give the lecture, but in taking part in the discussions. The members were more than obliged to him; and he thought they ought to give him their heartiest thanks.

Mr. C. B. Outon (Inchicore) said he should like to mention that the highly interesting lecture had been heard with gratitude on the part of all present. He seconded the proposition, with much cordiality.

The vote of thanks was very heartily accorded.

THE INFLUENCE OF ENRICHMENT ON THE HEATING POWER OF COAL GAS.

By M. Verdier, of Marseilles.

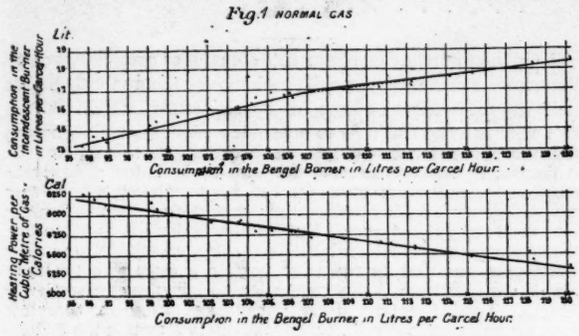
[A Paper read at the Annual Meeting of the Société Technique.]

In the large majority of towns, the existing clauses of gas agreements provide that the illuminating power, measured by the Bengel burner under recognized rules, must be 105 litres per carcel-hour. In order to attain this result, there are two methods usually adopted at the present time: (1) To obtain the required standard by the use of coal of superior quality, or by the addition of cannel to ordinary coal, and in this way to make, in the retort, gas of the desired lighting power, which may be called "normal gas." (2) To carbonize coal of ordinary quality, giving, as a rule, a lower result than the regular standard, and to enrich the gas by adding hydrocarbon vapours, particularly 90 per cent. benzol. In both cases, the gas sent out is the same, considered from the illuminating point of view, in the above-named burner.

The experiments we have made have been aimed at finding out if these two kinds of gas are equally the same as regards illuminating power measured by the incandescent burner, and as regards the calorific power. In our tests, the illuminating power in the Bengel burner was measured according to the recognized method, and the result reduced to 15° C. and 760 mm. dry (60° Fahr. and 30 inches). The lighting power in the incandescent burner was measured for a consumption of 120 litres per hour, under a pressure of 40 mm., and the result expressed in litres of gas per carcel-hour (calculated at 15° C. and 760 mm.). The burner having a ring permitted the internal air supply to be regulated, so as to obtain the maximum lighting effect for each kind of gas. The heating power was measured by a Mahler bomb and a Junkers calorimeter. Each apparatus gave similar results; and we expressed the heating power in calories per cubic metre of gas at 15° C. and 760 mm. dry. The tests were made with English Newcastle coal, the carbonizing conditions of which were altered so as to obtain lighting qualities varying from 95 to 120 litres. We purposely restricted the trials within these limits, which may be considered as the extremes reached in coal-gas manufactories, working with the classical processes. The results for "normal

gas" are shown in the following table; the figures in the first column giving the lighting quality of the gas in the Bengel burner, those in the second column the heating power per cubic metre of

Fig. 1. NORMAL GAS


Lit.
Consumption in the Incandescent Burner in Litres per Carcel Hour
Consumption in the Bengel Burner in Litres per Carcel Hour
Cal.
Heating Power per Cubic Metre of Gas Calories
Consumption in the Bengel Burner in Litres per Carcel Hour

gas, and those in the third column the consumption per carcel-hour in the incandescent burner (see fig. 1) :—

(1) Litres.	(2) Calories.	(3) Litres.	(1) Litres.	(2) Calories.	(3) Litres.
95·64	6264	14·26	105·89	5804	16·68
96·23	6215	14·78	106·14	5787	16·88
96·75	6134	14·63	106·30	5784	16·62
96·94	6060	14·41	107·16	5700	16·91
99·10	6153	15·27	108·80	5677	17·02
99·38	6090	15·50	110·70	5661	17·03
100·53	5996	15·69	111·10	5647	17·37
102·12	5915	16·03	112·32	5625	17·01
102·13	5927	15·54	112·52	5585	17·26
103·44	5903	16·02	114·07	5505	17·66
103·50	5925	16·07	115·28	5490	17·75
104·20	5874	16·29	118·30	5455	18·26
104·40	5814	16·65	120·20	5388	18·54
105·20	5803	16·83			

It is seen that the illuminating power, measured by the incandescent burner, depends very clearly on the quality of the gas as found with the Bengel burner, although there may not be an absolute proportion, the variations becoming less important as the quality of the gas decreases. The total difference between the 95 and 120 litres is from 14·2 to 18·5 litres per carcel-hour; that is, for the Bengel burner—

$$\frac{120 - 95}{95} \times 100 = 26 \text{ per cent.},$$

and for the incandescent burner—

$$\frac{18{\cdot}5 - 14{\cdot}2}{14{\cdot}2} \times 100 = 30 \text{ per cent.}$$

As regards the heating power, there is also to be noted the relation which exists with the lighting power in the Bengel burner. The variation between the extreme limits is from 6264 to 5388 carcels per cubic metre; that is, for the Bengel burner—

$$\frac{120 - 95}{95} \times 100 = 26 \text{ per cent.},$$

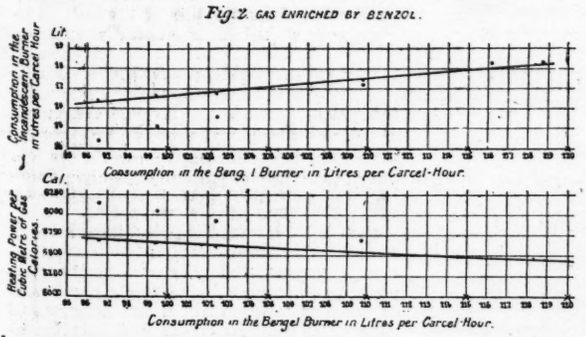
and for the heating power—

$$\frac{6264 - 5388}{6264} \times 100 = 14 \text{ per cent.}$$

The calorific power in the case of "normal gas," therefore, diminishes less rapidly than the illuminating power.

For carburetted gas, the tests were made by starting with a gas of the standard of 118 litres, and adding different quantities of

Fig. 2. GAS ENRICHED BY BENZOL.


Lit.
Consumption in the Incandescent Burner in Litres per Carcel Hour
Consumption in the Bengel Burner in Litres per Carcel Hour
Cal.
Heating Power per Cubic Metre of Gas Calories
Consumption in the Bengel Burner in Litres per Carcel Hour

benzol, so as to bring it successively to 110, 100, and 95 litres quality. The results are shown in the next table (see fig. 2) :—

Lighting Quality of the Gas in the Bengel Burner.	Benzol added per Cubic Metre.	Heating Power of the Carburetted Gas.	Calculated Heating Power.	Consumption in the Incandescent Burner.
Litres.	Grammes.	Calories.	Calories.	Litres.
118·30	..	5455	..	18·26
109·80	10·50	5527	5543	17·40
102·40	20·00	5641	5621	16·88
99·46	23·50	5668	5650	16·75
96·57	27·00	5701	5679	16·42

We see that in this case the incandescent burner only shows very slight variations compared with the corresponding figures in the "normal gas" tests. The influence of benzol is, therefore, insignificant under these conditions. The heating power undergoes a change in the same way, but less marked than in the normal gas. Thus, for a variation in the lighting power of

$$\frac{118{\cdot}30 - 96{\cdot}57}{96{\cdot}57} \times 100 = \text{about } 22 \text{ per cent.},$$

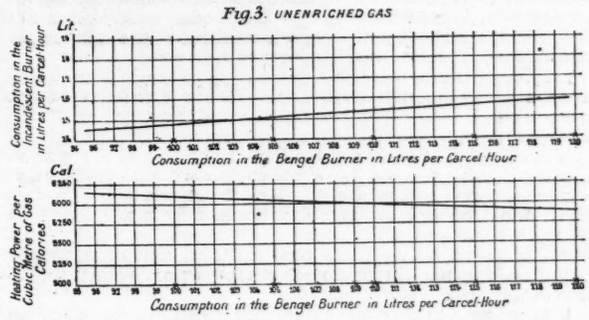
the heating power only changes by

$$\frac{5701 - 5455}{5701} \times 100 = \text{about } 4{\cdot}5 \text{ per cent.}$$

Moreover, these heating powers are absolutely consistent, as can be verified by the results arrived at by the following calculation: Starting from "normal gas" of 118 litres standard, having a heating power of 5455 calories, the addition of 20 grammes of benzol per cubic metre brings it to 102·40 litres quality; and the calorific power (which for 1 gramme of benzol is about 10 calories, a litre of benzol vapour weighing about 3·5 grammes), becomes 5621 calories, whereas the actual experiment gave us 5641 calories.

Some tests were made with a view to gaining information in an inverse way to that of enrichment—that is to say, by taking from the gas the illuminating hydrocarbons by more or less quickly passing through a scrubber filled with shavings soaked in heavy

Fig. 3. UNENRICHED GAS


Lit.
Consumption in the Incandescent Burner in Litres per Carcel Hour
Consumption in the Bengel Burner in Litres per Carcel Hour
Cal.
Heating Power per Cubic Metre of Gas Calories
Consumption in the Bengel Burner in Litres per Carcel-Hour

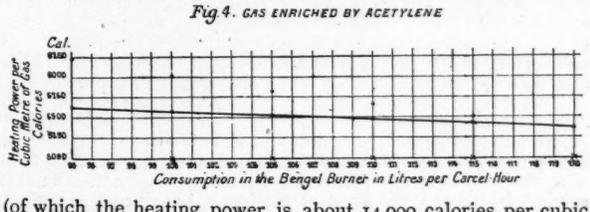
oil. Gas of 95 litres quality was thus brought to 105 and 115 litres. The results are shown by the following table (see fig. 3) :—

Lighting Quality of the Gas in the Bengel Burner.	Heating Power per Cubic Metre of Gas.	Consumption in the Incandescent Burner per Carcel-Hour.
Litres.	Calories.	Litres.
96·75	6134	14·63
104·25	6064	15·13
118·28	5948	15·73

The results can be absolutely compared with those obtained in the preceding case; there being a slight variation in the consumption by the incandescent burner, and a less important reduction in the heating power than in the case of the "normal gas."

Let us consider now a third method of enriching coal gas, which, however, is only of theoretical interest—enrichment by acetylene. Referring to the results given to the Society by M. Vautier, at the congress in 1897, on enriching poor gas by acetylene,* we see that, in order to carburet gas having a quality of 120 litres, and bring it to 110, 105, 100, and 95 litres, it is necessary to add successively about 0·6 per cent. of acetylene for a gain of 5 litres in the lighting quality. M. Vautier shows that, in this case, the yield from the incandescent burner is not improved by the fact of adding acetylene. By applying the calculation we have worked out in the case of enrichment by benzol, we can deduce the calorific power of mixtures of gas and acetylene

Fig. 4. GAS ENRICHED BY ACETYLENE



(of which the heating power is about 14,000 calories per cubic metre), and obtain the following table (see fig. 4) :—

Lighting Quality of the Gas in the Bengel Burner.	Heating Power per Cubic Metre.	Consumption in the Incandescent Burner per Carcel-Hour.
Litres.	Calories.	
120	5375	
115	5426	
110	5477	Practically Constant.
105	5528	
100	5579	
95	5630	

From the whole of the foregoing tests, some interesting conclusions can be drawn concerning the heating and illuminating value of coal gas. Owing to the great development made by the incandescent burner, and the extension of the uses of gas for heating and motive power purposes, tendencies arise, which are

* See "JOURNAL," Vol. LXX., p. 1341.

certainly very legitimate, to give the heating power of the gas greater importance than its illuminating power in the Bengel burner. It may be remarked, as the above experiments show, that the close relationship between the heating and illuminating power of coal gas—a relationship which continues, in a general way, in limits much more extended than those within which we have voluntarily restricted this paper—only holds good in the case of pure coal gas, as M. Aguitton showed as far back as 1893*. It must not be forgotten that neither is it the same in the case of enrichment by benzol, for example, and that, in this instance also, the improvement of the lighting power is much more rapid than that of the heating power.

Let us consider a normal gas of 110 litres quality, and with a heating power of 5660 calories. We know that with about 6 grammes of benzol, we bring this gas to 105 litres quality. But if we inquire what quantity of benzol would be required to bring it to 5800 calories, which is the heating power of normal gas, corresponding to 105 litres, we find that 17 grammes per cubic metre will be wanted. This example is sufficient to show that, in considering the calorific value of gas, enrichment by benzol would quickly become very onerous as regards the cost of the enricher. Acetylene, which develops about 14,000 calories per cubic metre, and costs at the lowest, if we take the figures given by M. Vautier in 1898, 1·30 frs. per cubic metre, is out of comparison with benzol, which gives us about 10,000 calories per kilogramme, at a price varying from 45 c. to 50 c.

It is seen that, to obtain a high heating power, it is necessary to use coals of superior quality, or a mixture of coal and cannel. Also, through seeing how, in the case of "normal gas," the calorific power rises but slowly compared with the lighting quality, it is right to ask if the higher net cost of the gas, on account of using rich coal, is not out of proportion to the increase obtained in its heating power. Does it not seem obvious that there would be an advantage for the manufacturer as well as for the consumer to make a gas of lower quality, yet having a calorific power higher than 5000 calories, and consequently requiring in its manufacture neither superior coals nor the addition of any special enrichment?

I do not wish to conclude this paper without calling attention to the fact that the results given to the meeting have been obtained with unscreened Newcastle coal, carbonized in horizontal retorts of the usual shape. But it is very possible that the gas obtained from coals of different origin may give the same illuminating, yet varying calorific, power. In fact, the immediate composition of the gas obtained by carbonizing English, Loire, or German coals is not identical, even when the lighting power of the gas, measured in the Bengel burner, is the same. It results from this that, in the future, it will no longer be necessary, if the calorific value of the gas be taken into consideration, and enter into every-day practice in gas-works, to find coals giving per ton the greatest yield in carcels, but those yielding the maximum return in calories. In consequence of this, a different classification from that which is adopted at present, as regards the value of various qualities of gas coal, will be required. There is, therefore, room for a fresh study of these particular coals. Perhaps, also, one may expect to see introduced into our works methods of carbonization different from those which have been followed up to the present time. Everything has been subordinated, up to now, to the first care of keeping in the gas made a maximum of certain very illuminating hydrocarbons, but the small proportion of which influences the calorific power comparatively slightly. In the new order of ideas opening before us, this primary attention will become secondary.

With regard to the utilization of the incandescent burner, absolutely the same remarks can be made as were offered with reference to the heating power. Even in this case, the various processes of benzol and analagous enrichment give no longer any appreciable result; and, from this point of view, the only solution would be to raise the illuminating value of a gas by using exceptionally rich coals. Moreover, there can be no question for the moment of making this burner the standard for the quality of the gas. There are too many variations to be taken into account; the constants of the burner, and above all the quality of the mantle, being capable of causing much greater differences than the quality of the gas tested. Of course, these laws are not now to be considered, seeing that gas other than pure coal gas is used, especially a mixture of coal and water gas, either carburetted or not. On this subject, we find in the work of Professor Lewes and Mr. T. O. Paterson, in England, and of Dr. Bunte, in Germany, some interesting facts on the calorific power of water gas, and mixtures of water and coal gas, and some investigations on the way in which they behave in the incandescent burner. These data do not offer at present any positive interest for works in France, where the adoption of water gas does not seem to be so immediately required in practical working; and the results just given apply particularly to works in which coal gas is manufactured by the ordinary means.

Coke ashes from gas-works are now being made into bricks by a simple process. The ashes are reduced to a fine powder, mixed with one-tenth part of slaked lime, and, after the addition of water, pugged until the mass forms a stiff paste. It is then treated like ordinary clay, and formed into bricks, which are stacked, protected from rain, and dried in the air—no artificial heat being used.

* See "JOURNAL," Vol. LXII., p. 402.

ESTIMATION OF PHOSPHORUS AND SULPHUR IN ACETYLENE AND OTHER COMBUSTIBLE GASES.

The advent of acetylene into the domain of artificial gaseous illuminants has raised several problems for the analyst who has made the examination of gas his special study, which did not arise so long as he had only to consider such commercial gaseous mixtures as coal gas, oil gas, carburetted water gas, &c. In particular, it was unnecessary for him to look for phosphorus compounds in these mixtures, for the very sufficient reason that he would never have been able to discover phosphorus in them in more than negligible traces. But with acetylene it is otherwise. The crude gas contains a variable, but quite appreciable, amount of phosphorus, and that for the most part in a form which is liable to cause trouble both in the generation and in the combustion of the gas. The estimation of the phosphorus in the gas therefore becomes an important problem for the analyst; while the estimation of sulphur in acetylene also presents features which make the ordinary processes for ascertaining the quantity of sulphur in coal gas inapplicable to it. The more prominent of the earlier methods proposed for the determination of phosphorus, sulphur, and other impurities in acetylene have been from time to time fully described in the "JOURNAL." But a more recent research, inspired by Dr. Bunte, on the accuracy of some of these methods, is well worthy of the attention of those who may be called upon to determine phosphorus and sulphur, not only in acetylene, but also in some other combustible gases. The research has been carried out by Drs. P. Eitner and G. Keppeler in the Chemical-Technical Institute at Carlsruhe, and has been described in a communication to the "Journal für Gasbeleuchtung."

Wilgerodt determined the phosphorus and sulphur in acetylene by treating it with bromine water, which oxidized their compounds. The acetylene was converted into a tetrabromide, and thereby an enormous amount of bromine was used up. The method consequently was an inconvenient one; and, moreover, only those compounds of phosphorus and sulphur which are oxidized to phosphoric acid and sulphuric acid by bromine were estimated. Another well-established method is that of Lunge and Cederkreutz, and it is far more convenient than Wilgerodt's. The acetylene is passed through solution of sodium hypochlorite (produced by double decomposition from chloride of lime and soda), which is supposed to retain the phosphorus and sulphur compounds, while not attacking the acetylene. It does not seem, however, to have been satisfactorily established that certain of these compounds do not escape determination both by this and by Wilgerodt's method. Ahrens has detected phosphorus by means of potassium permanganate in acetylene purified by the hypochlorite. Also when a train of ten bulbs containing the solution of sodium hypochlorite has been employed, phosphorus has been found even in the last of them; and it has therefore been argued that some must have passed on in the gas issuing from the last bulb. But that is scarcely a valid argument; because, if the hypochlorite in (say) the third bulb is in a position to oxidize a phosphorus compound, the oxidation may equally well have been effected in the anterior bulbs by a proper regulation of the rate of flow of the acetylene through them. On the other hand, the finding of phosphorus in the last bulb indicates that the acetylene being tested by the Lunge and Cederkreutz method can be passed through the bulbs at a moderate rate of flow only.

Potassium permanganate has been used by Ahrens, as already mentioned, to oxidize phosphorus compounds which had escaped the action of sodium hypochlorite; but it does not appear to be preferable to the latter for the determination of the bulk of the phosphorus and sulphur compounds, because it oxidizes not only them but also the acetylene. Hence the consumption of potassium permanganate in a determination would be very great. For instance, 1 cubic foot of acetylene requires about 640 grammes of the permanganate for its oxidation; and about 10 litres of water would be needed to dissolve this amount of the salt. This large volume of liquid would make the determination of small quantities of phosphorus and sulphur a very troublesome matter.

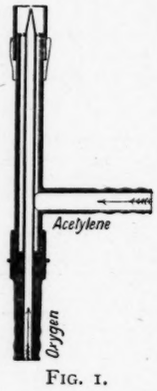


FIG. 1.

Drs. Eitner and Keppeler hoped to get over the difficulties attendant on the methods already enumerated by determining the phosphorus and sulphur by complete combustion of the acetylene, much in the same way as sulphur is determined in coal gas by the Gas Referees' test. The modification of the Referees' sulphur test, which is best known in Germany, is one devised by Drehschmidt; but it cannot be satisfactorily applied to acetylene, because of the large quantity of air required to burn that gas with a smokeless flame, and of the great volume of the resulting products of combustion. Small quantities of sulphur are apt to escape from the apparatus, and the time required for the test is very great, owing to the extreme smallness of the flame which must be used. Hence Drs. Eitner and Keppeler decided to try replacing by oxygen the air needed for the combustion of the acetylene,

and adapted the burner to this change. The arrangement of the burner shown in the preceding diagram (fig. 1) is the one which they found by trial to be most satisfactory. The burner consists of a small blast burner, resembling that known as Daniell's. It comprises a removable cap, closed at the top by a platinum plate having a central hole. Beneath this is the oxygen nozzle, likewise made of platinum, and held exactly in the centre by a brass disc having holes in it. The orifice of the oxygen nozzle is slightly smaller than the hole in the platinum plate just above it, and is so placed in relation to it that the jet of oxygen draws the acetylene with it through the upper hole. This position of the hole relatively to the nozzle may be readily secured by moving up and down the cap which carries the platinum plate. Any escape of gas between the cap and the burner-tube is prevented by drawing over their junction a piece of rubber tubing. The burner attached to a

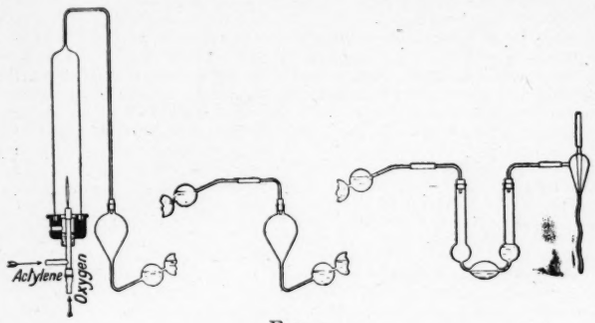


FIG. 2.

porcelain mounting is fixed beneath a glass hood, such as is employed by Drehschmidt in place of the trumpet-tube of the Referees' sulphur-testing apparatus. The exit-pipe from the top of this hood is connected to two tubes, each having ten absorption bulbs and to a bulbed U-tube, placed one after the other, as shown in the illustration (fig. 2). The first of the tubes of ten bulbs is charged with pure water, and the second with a solution of sodium hypobromite (made by adding bromine to a solution of caustic soda), while the U-tube is left empty, with the object of catching any liquid sprayed over from the preceding tubes. The whole is then connected to a suction-pump, by means of which the products of combustion of the acetylene can be drawn through the apparatus in a moderately fast stream. The passage of the products through the tubes will take place in a less jerky manner if the first tube of ten bulbs be smaller than the second.

After the apparatus has been set up as shown in the second illustration, with the bulb-tubes charged as described above, the suction-pump is started, and its action regulated so that the bubbles of air can just be counted as they pass through the second bulb-tube. The acetylene burner is then lighted while outside the apparatus, and the height of the flame made such that rather less than one-third of a cubic foot of acetylene is consumed per hour. The gas is measured by an experimental wet meter, in which a concentrated solution of common salt, which has been saturated with acetylene of similar origin, is used in place of water. The oxygen tap is then cautiously opened, and the supply of oxygen is regulated so that the acetylene burns with a flame which is non-luminous, or nearly so. If the conditions have been properly arranged, the velocity of the stream of gas will be somewhat higher at the orifice by which it issues from the burner than the velocity with which the combustion is propagated, and consequently the flame will not quite touch or rest on the platinum plate.

As soon as the flame has been properly regulated, it is brought under the glass hood, and placed so that the lower edge of the hood rests in the trough in the porcelain mounting. The products of combustion of the acetylene, which is measured with precision, are then drawn through the absorption vessels after dilution with a little secondary air. Should it be deemed necessary to purify the secondary air before its introduction, as may be the case in some instances, the trough is filled with mercury, which forms a seal for the lower edge of the hood. The secondary air, after suitable purification, is then introduced through the opening shown in the lower part of the porcelain mounting.

As soon as the proper quantity—usually 0·75 to 1 cubic foot suffices—of acetylene has been burnt, the test is stopped, and the contents of the absorption tubes are brought together, and the tubes carefully washed out with hot water. The mixed contents of the tubes and washings are treated with hydrochloric acid, and boiled, in order to get rid of the hypobromite. The liquid is then made ammoniacal, and filtered while hot, in order to remove soot, silica, &c. A large proportion of the phosphoric acid formed deposits itself, however, on the walls of the glass hood, and attacks the glass. The hood is therefore specially treated by being turned upside down, filled with hot water acidified with hydrochloric acid, and left to stand overnight. The contents are then concentrated in a porcelain basin, and ammonia and ammonium carbonate added. The silica and other impurities which separate out are then filtered off, and the filtrate is added to that from the absorption-tubes.

After thorough cooling, the phosphoric acid in the liquid is precipitated by means of a magnesia mixture, and determined in the usual manner as magnesium pyrophosphate. It is advisable, however, after weighing the pyrophosphate, to dissolve it, in order to detect and, if found, to remove, any contamination of silica present in it. The excess of ammonia is removed from the filtrate from the precipitation of phosphoric acid by boiling, and the liquid is then acidified with hydrochloric acid, and the sulphuric acid present is precipitated with barium chloride, and determined in this usual way.

Drs. Eitner and Keppeler report that the method of estimation just described is exact and convenient. There can be no question, they say, that all sulphur and phosphorus compounds in the acetylene are completely burnt in the oxygen-fed flame, while they have satisfied themselves by a special series of experiments that the products of oxidation are wholly absorbed in the apparatus. These experiments showed that all of the phosphoric acid was retained on the glass hood and in the first tube of ten bulbs. Only when water had been spirted over from the first to the second tube was phosphoric acid found in the latter. The sulphur also is said to be completely converted to sulphuric acid and retained, provided a solution of sodium hypobromite is employed in the second tube of ten bulbs. It is, of course, essential to a correct determination that the rate of flow of the products of combustion be kept within moderate bounds.

The authors further compared the results obtained by this method with those given by that of Lunge and Cederkreutz already referred to. They used acetylene from one gasholder for the two methods of determination simultaneously. A 2 per cent. solution of sodium hypochlorite was used according to directions, and the gas passed through it at a rate of one-sixth of a cubic foot per hour. Only the phosphorus in the acetylene was estimated in this series of experiments; and the results obtained with four different samples of acetylene were as follows:—

—	Grains of Phosphorus per 100 Cubic Feet of Acetylene.	
	By Hypochlorite (Lunge and Cederkreutz's) Method.	By Combustion (Eitner and Keppeler's) Method.
1	19·2	21·8
2	19·2	26·2
3	24·0	28·0
4	24·0	29·3

Thus there was always found by the combustion method more phosphorus than by the hypochlorite method. But, in order to make sure that the differences were not due to accidental differences in the arrangements for the tests, a second series of experiments was instituted, in which acetylene which had been treated by hypochlorite according to Lunge and Cederkreutz's method was collected over concentrated brine, and then examined for phosphorus according to the combustion method. The results obtained from four independent trials were as follows:—

—	Grains of Phosphorus per 100 Cubic Feet of Acetylene.		
	Retained by the Hypochlorite.	Subsequently found by Combustion.	Total.
1	9·2	8·7	17·9
2	26·2	9·2	35·4
3	6·6	13·5	20·1
4	17·5	3·1	20·6

These results show that the usual method of carrying out the estimation of phosphorus in acetylene by means of hypochlorite does not ensure its complete oxidation and proper determination. It is not necessary to consider whether acetylene contains phosphorous compounds of which the phosphorus cannot be converted into phosphoric acid by means of hypochlorite, or whether merely the speed at which the reaction occurs is so low that the rate of flow of the gas through the absorption vessels would have to be reduced to such an extent, in order that all the phosphorus should be retained, that the method would become impracticable. In any case, the combustion method proposed by Drs. Eitner and Keppeler appears to be exact and convenient; and it should prove of service, especially in investigating the efficiency of purifying agents for acetylene.

Finally, Drs. Eitner and Keppeler point out that the combustion method, with the use of oxygen, is applicable to the determination of phosphorus and sulpbur in other gases as well as in acetylene —*e.g.*, in methane obtained, for instance, from aluminium carbide. Combustible liquids could be similarly examined by carburetting air, or, for choice, hydrogen, with them, and burning the gas thus obtained in the manner described for acetylene.

Origin of Coal.—In the current number of "Engineering," a Fellow of the Geological Society deals with a paper on this subject read by Mr. Aubrey Strahan, of the Geological Survey, before the Society last June. The author of the paper suggested the following general sequence of events as preceding the deposition of a normal coal seam: (1) The outspreading of sand or gravel with drifted plant remains, followed by shale as the currents lost velocity; (2) the gradual retreat of the water, leaving the surface open to the air; (3) the deposition of very fine sediments; (4) the rooting of vegetation in the deposit so formed, in which mass were caught wind-borne vegetable dust and floating vegetation.

REGISTER OF PATENTS.

Ignition Devices for Incandescent Gas-Burners.—Boult, A. J.; a communication from A. Kraetke, of Berlin. No. 14,781; Aug. 17, 1900.

This invention is distinguished by the use of an easily removable ignition-ball, arranged centrally so as to effect noiseless ignition while being protected against the direct action of the flame.

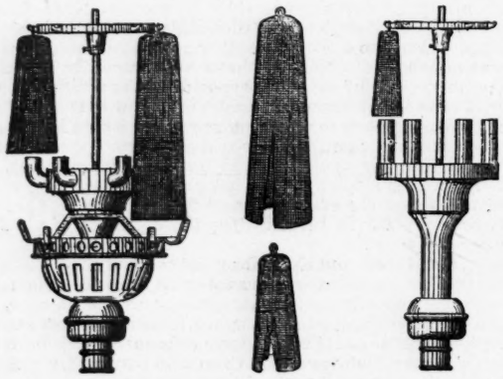
As shown, the device consists of a support, provided at the lower end with a depending rod A, by means of which the device can be secured in the central aperture of a burner head of the usual Welsbach construction, or of any burner provided with a mantle support or fork. From this rod extend several arms carrying a perforated plate B, above which the ignition-ball C is arranged; while a fork, arch, or the like springs from the top of the plate, and is centrally provided with an upwardly extending tube D, in which the mantle fork is placed in the usual way. The ignition-ball is suspended in the axial central line of the burner, and consequently is not under the direct action of the flame—the more so as it is protected by the plate B.

Manufacture of Incandescent Burners and Incandescible Elements Therefor.—Lery, J. B. de, of West Kensington. No. 22,694; Dec. 12, 1900.

This invention refers principally (though not exclusively) to "that branch of lighting wherein a greater diffusion of light is obtained by dividing a given amount of gas energy into a number of small jets, and also dividing a given amount of incandescible element into smaller ones—distributing as it were a number of sources of light in such a manner as to obtain a larger area of illuminating effect." One object aimed at is to render it convenient for the manufacturer to prepare for trade incandescible elements—whether tassels, mantles, or other incandescible elements—without first having to burn them, then form them, and lastly dip them, into collodion in order to allow them to be handled. A further object is also to provide "an improved incandescent burner that will shed its light at a downward angle; so that the user may have the use of the full energy of his gas directed where it is most wanted."

The first part of the invention is carried out by so arranging the burner with regard to the mantle, and the means for suspending the mantle, that the mantle, before it is burnt, may hang freely around the nozzle of the burner. In this way, the orifice of the nozzle whence the flame issues may be approximately on a level with the middle of the height of the mantle, in order that when the mantle is burnt off, and consequently shrinks, the lower edge of the mantle may be approximately on a level with the orifice of the nozzle. As the mantle shrinks in diameter as well as in length, the diameter of the nozzle must also be so much smaller than the diameter of the unburnt mantle that the latter does not tighten about the nozzle when shrinking.

In the present-time mantle, the tendency of the rays of light is to pass upwards—requiring the use of a reflector to cast down some of the light. The patentee, however, says he has found that where the incandescent body takes the form of a mantle which is slit so as to consist of dependent parts which may spread outward more or less from one another, the rays of light have a tendency to fall downwards; this tendency being more pronounced when small mantles or tassels are used in conjunction with the burner with curved nozzles that he illustrates and describes. The use of this burner will, he says, materially help in solving the problem of shaping split mantles or divided tassels as they hang suspended above each tube of the burner from the radial arm of a star-shaped support or otherwise.



The burner proper is made (as shown) of a small reservoir to receive the mixture of gas and air emanating from a bunsen base screwed at the end of the gas-pipe. For undivided mantles, the upper face of the reservoir has, near its edge, a series of vertical nozzles of the required dimensions; for slit mantles, the periphery of the reservoir carries, in place of the vertical nozzles, a series of bent or curved nozzles of the required dimensions—the nozzles curving upwards with their orifices either above or below the surface of the reservoir. The slit mantle or tassel is placed so as to have the slit portion straddling the part of the curved tube which horizontally leaves the reservoir, while the upward part of the tube is inside the mantle or tassel. When each mantle or tassel has been adjusted, so as to cover each nozzle in the manner described above, the gas is turned on and lighted for the purpose of burning the cotton of which the fabric of the mantles or tassels is composed. It is therefore obvious that the nozzles being inside the mantles or opened tassels, the force of gas will keep the latter in shape while the burning process is taking place, leaving the skeleton of incandescible earth sufficiently well formed to allow of brilliant incandescence. The mantle or tassel after shrinking remains slightly above, or possibly falls a little below, the orifice of the nozzle.

The illustrations show: (1) An elevation of the burner with curved nozzles, with an unburnt mantle on the right and a burnt mantle on the left. (2) An elevation of a burner with straight nozzles showing one burnt mantle thereon. (3) A perspective view of an unburnt slit mantle. (4) A similar view of the same mantle after burning.

Electrically Controlling and Igniting and Extinguishing Gas from a Distance.—Borchardt, H., of Berlin. No. 9097; May 2, 1901.

This invention comprises (1) A special arrangement of electro-magnetic operating or controlling mechanism, to adjust the position of the plug of the gas-cock, and as far as practicable to secure it against any accidental displacement, which, whether for purposes of opening or closing, is capable of being turned in one direction only—viz., to either of several positions, at an angle of 90° to each other; and (2) a novel construction of electrical switch apparatus, by which, with the aid of a contact-maker or switch, movable in a circle over a series of contacts, the electrical system is operated. One important feature of the latter apparatus is that the number of contacts within the circle controlled by the switch is equal to the number of forward movements which the ratchet-wheel on the gas-cock is required to perform in order to open or close the cock. Thus the situation occupied by the switch at any time indicates what the position of the gas-cock at the moment happens to be. Means are also provided whereby, when the cock has reached either of its main positions—*i.e.*, is full "on" or full "off"—an arresting effect for preventing accidental displacement may be produced.

The arrangement adopted in order to ensure exactitude of the respective positions, and also (when required) a normal succession of contacts, consists of a catch device serving to lock the switch against any rearward rotation; the preferred form in which this arrangement is carried out being that of a pawl, which is itself adapted conveniently to act as a contact-making switch, in conjunction with contacts constructed in the shape of arresting teeth.

A further improvement in the controlling arrangement with the revolvable controlling switch or contact-maker is that the rate of progress or speed of the latter, as it turns, is confined within predetermined limits by means of a swinging armature controlled by a spring. Thus the possibility of too rapid a succession of contacts, which might lead to faulty operation of the switch device, is obviated. And, lastly, the arrangement of the gas-cock opener is, for distance lighting purposes, supplemented by the combination of the controller with an additional switch, which serves to close an electrical gas-igniting circuit, but which can only be effectively operated while the gas-cock is opened.

Retort-Charging Apparatus.—Bronder, G. A., of New York. No. 11,145; May 30, 1901.

This invention relates to improvements in the gas-retort charging apparatus described in patent No. 3577 of 1895, the essential elements of which consisted of a retort-house with tracks running in close proximity to, and parallel with, the mouthpieces on each side of the retort-stacks. A double carriage was arranged to run on the tracks under its own steam and propelling gear, consisting of a main carriage and a cross carriage carrying the scoops which charge the retorts. The main carriage was fed with coal from bins spanning the retort-house across its width, and between the adjacent ends of two retort-stacks placed longitudinally in the house.

The main objects of the present application are: To dispense with the boiler and water-tank carried on the main carriage, and substitute a steam receiver; novel-locking devices for the scraper-frames and scoops; adjusting attachments to direct the scoops in proper operative positions into the retorts; ploughs for properly distributing the coal fed into the retorts; a coal-hopper with pushers to feed the coal into the scoops in varying quantities; chains fitted with elastic mediums to prevent shocks or jars when the movements of the scoop-carriage are stopped and reversed; and bars to stir the coal in the delivery openings of the hoppers. The organization comprising the invention consists of a main carriage, a scoop-carriage operating thereon, a driving engine for the main carriage, and an engine geared with the scoop-carriage, a hopper, and a steam receiver secured to the main carriage, scoops operating on the scoop-carriage, buffer springs connected to the chains running from a drum driven by the scoop-engine, ploughs attached to the scoops, scraper frames operating with the scoops, scrapers and ploughs carried by the scraper frames, locking devices locking the scoops to either carriage, locking bar angles on the main carriage connecting the frame of the main carriage with the hopper, locking bars journalled to the locking bar angles, cams on the scoop-carriage engaging the locking bars, adjusting cams on the locking bar angles, adjusting rollers on the scoops operating with the adjusting cams on the locking bar angles, a spindle on the scoop-carriage, and friction and adjusting rollers carried on the spindle.

[The arrangement is not describable apart from a series of seven sheets of detail drawings (with 37 figures) bristling with reference letters throughout the eight pages of printed specification.]

APPLICATIONS FOR LETTERS PATENT.

16,152.—Bergmann, A., "Air controller for bunsen burners." Aug. 12.

16,158.—Barclay, H. V., "Breaking or disintegrating the surface of streets or other spaces covered with concrete, broken stone, asphalte, bitumen, or other substance of a hard nature." Aug. 12.

16,162.—Kemp, C. M., and Denny, G. H., "Bunsen burners." Aug. 12.

16,184.—Crombie, H. S., "Pipe-couplings." Aug. 12.

16,211.—Johnson, J. Y., "Manufacture of gas and coke." A communication from the Deutsche Continental Gas-Gesellschaft and J. Bueb. Aug. 12.

16,239.—Tully, C. P., "Manufacture of producer and water gas." Aug. 13.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Gasholder Discussion at the Irish Association Meeting.

SIR,—The holder about which I read a paper at the recent meeting of the Irish Association of Gas Managers was a three-lift one when originally built. I think your reporter has evidently got mixed about the discussion, as Mr. Kirkham spoke twice—the first time with reference to the Waterford holder, and the second time with reference to one at New Ross, where a single-lift was converted into a double-lift holder. Hence the remarks *re* holders and directorate in the leaderette in the "JOURNAL" for the 20th inst. do not apply.

Waterford, Aug. 22, 1901. J. G. TOOMS.

SIR,—Mr. Tooms, the Manager at the Waterford Gas-Works, read a paper on "Some Difficulties with a Gasholder" at the recent meeting of the Irish Association of Gas Managers. All that he therein said was true; but the discussion that followed was incorrect, in consequence of a member who stated, as if from local knowledge, that the tank in question was an iron one, formerly containing a single-lift holder, which was converted into a three-lift one. This led you, in your editorial, to make some unfavourable remarks. The Waterford Gas-Works have been in my hands for over forty years. There never was a cast-iron tank in the works, and there never was a single-lift holder made into a three-lift one. I need say no more.

35A, *Great George Street, S.W., Aug.* 23, 1901. GEORGE ANDERSON.

The Suggestion for "Standardizing" Meter-Unions.

SIR,—At the present time the matter of standardizing meter-unions has to be decided. If we go back to the period when gas-meters were first invented, and the original makers were alive at the present time, and the Board of Trade with their Standards Department were then in existence, there would have been no difficulty. The original inventor of meters and the head of the Department could then have arranged certain standards to suit those who have to use meters. At the present time, the question has to be decided at Glasgow, at a conference upon various gas matters. Being connected with the manufacture of meters, I cannot see that they can decide upon a standard which will give satisfaction all round.

As a gas-meter manufacturer, I should court any distortion from what any gas company are at present using. The last phase is that the London standard should be adopted. There is no London standard; and there is no Board of Trade standard. But what happened many years ago was this—that one of the largest gas companies requested each gas-meter manufacturer to send in a sample of his bosses, unions, and linings; and from these a certain firm gained possession of the unions and supplied the same Company with a male and female iron or steel part which was not in conformity with the majority of the other makers. On the top of this, a certain set of gauges was sent to the Standards Department of the Board of Trade for their adoption. At the present time certain makers are desirous to call this a London standard; but the whole thing will not attain the end that the gas industry requires—viz., that a standard should be adopted which would save gas companies expense in fixing meters. This may be rather alarming to many who have gone into the question; but seeing that all companies have to buy their own meters, they have a perfect right to demand that the unions should be made to suit their own company. If gas companies had to buy meters and to transplant them to another company, there would be some reason in asking the Board of Trade to decide which was the proper standard.

Not wishing to refer to any particular company, pardon me giving you two outside names. Supposing Timbuctoo has bought a large quantity of meters, and these meters have been fitted into houses where the caps and linings have been fixed. If the new standard is adopted, the Timbuctoo company, if they buy a meter from another maker will have to disconnect the caps and linings to suit the new standard, which would be a very large expense. Now we will imagine that the Timbuctoo company wish to exchange these meters with the inhabitants of the Sandwich Islands. They can then ask the Timbuctoo company when they buy these meters what is their standard gauge, so that they can adopt them in the meters that are going to be bought and sold in the Sandwich Islands.

These may be very frivolous remarks; but the two names have been arranged to call the attention of large companies to the necessity of compelling everybody to adopt the London or the Board of Trade standard, which is a perfect myth. There is no London standard; there is no Board of Trade standard. At the present time, nothing is definite except deception on the part of meter manufacturers to arrive at the same. The remarks are open to discussion. The remedy is this: That each company should for itself decide upon a certain—not only boss, but—cap and lining, and that in the event of a company wishing to adopt a new manufacture, they should, in the interests of the company, first ascertain, not by a supposed standard gauge, but by actual proof (from the meters in their district), which boss, cap, and lining will suit them best.

I might call your attention to the following: That a company who have not less than 20,000 meters in existence employ a man, who has his brains about him, who knows exactly where a meter is made, and by which maker. He also keeps a record of all meters that come in, and of all meters that go out; of how long they have done their duty; and with what satisfaction to the consumers and the company; also the cost of repairs. He further keeps a record of how many meters are in the store which cannot be used owing to their defective manufacture; also a record of what the old meters are sold for as scrap iron. And these in the various gas companies amount to a large capital being expended on meters which, though in store, are merely scrap iron.

I send you this letter with one object—to open up discussion from the large gas companies; and while appreciating the difficulty of the small companies who are continually changing their manufacture, getting from them information as to whether they wish the Government to insist upon a standard, or whether they wish the small companies to be hampered by going to the expense of changing the caps and linings which are already fixed in houses. Nothing would delight us better than for the conference which is to be held in Glasgow to decide upon a standard set of unions totally at variance with what we are at present manufacturing, because we should then have to charge them with the expense of putting new bosses into every meter that is returned to us for repair. But, on the other hand, what about the expense of gas companies having to send a skilled man to disconnect the old lining and cap from each house, and running the risk of blowing joints from any other causes, to have to screw on the unions to an iron barrel connection. This is a very large item for gas companies. To gas-meter manufacturers the expense is small; but gas companies will have to pay a very large amount for adopting any standard which will necessitate this expenditure.

Aug. 19, 1901. J. N. O.

Profit Sharing for the Commercial Company's Workmen.

SIR,—As Chairman of the meeting of the Company's workmen, held at the Durham Row Radical Club, on Sunday, the 11th inst., to consider the question of signing the profit-sharing scheme, will you kindly allow me to correct two mis-statements made in your issue of Aug. 13, in which you state that the meeting was not representative of the three stations—there not being more than thirty men present. Whoever your informant may have been, he does not seem to know how to speak the truth or believe in fair play, as I can honestly say that there were quite 130 men present; and at the meeting held at Poplar on Sunday, Aug. 4, there were about 350 present. I think, Sir, you will admit that these numbers should fairly represent the three stations.

Again, it is stated that it is free for every man to accept or decline the offer as he pleases. I am sorry to say this is not so. Some of the men have already been threatened with boycotting if they did not sign; or my informant is, like yours, void of the truth. THE CHAIRMAN.

34, *Coborn Road, E., Aug.* 22, 1901.

[We publish the above letter in order that we may not be accused of unfairness; but at the same time we are sorry it has been written. It is only necessary for us to refer to the first paragraph; and, in regard to it, we cannot accept our correspondent's enumeration of the Commercial Company's men who were at the meeting held at the Durham Row Radical Club. The addition of 100 to the figure which we mentioned as having been present on that occasion naturally raises a doubt in ones mind as to whether some mistake has not been made in the number given for the Poplar meeting. However, it is rather curious that our correspondent should have been so long calling attention to the statement of which he now complains. It was published in the "JOURNAL" for the 13th inst.; but his letter was only written on the 22nd inst., by which time he had doubtless heard that the resolutions passed at the two meetings held under the auspices of the Gas-Workers' Union did not exactly square with the ideas of the majority of the Commercial Company's employees. With the second paragraph of the letter we have nothing to do. The emphatic declaration therein made may safely be left in other hands to deal with if it is thought worth while.—ED. J.G.L.]

Silsden Gas Supply.—A ratepayers' meeting has been held at Silsden, to consider the desirability of the District Council taking steps towards the establishment of gas-works for the district. For many years the Council have had a supply of gas in bulk from the Kildwick Parish Gas Company, and distributed it; but the present agreement with the Company will shortly expire, and, acting upon the report and advice of Mr. E. A. Harman, the Gas Engineer to the Huddersfield Corporation, the Council have decided to establish gas-works. The resolution approving the Council's decision was adopted unanimously.

Colney Hatch Gas Company.—At the meeting of this Company last Thursday, the accounts presented showed that in the six months ending June 30 last the sale of 36,757,500 cubic feet of gas for public and private lighting produced a revenue of £7351—the total receipts being £9942. The expenditure amounted to £8309; so that £1633 was carried to the net revenue account, the balance on which was £4529. Compared with the half year ended June 30, 1900, the sale of gas showed an increase of 3 per cent. The additional income was £914 15s. 7d.; but, on the other hand, carbonizing materials cost £965 18s. 7d. more. The Directors recommended the payment of dividends at the maximum rates per annum for the half year—viz., on the original shares at the rate of 10 per cent.; on the additional shares and stock at the rate of 7 per cent.; and on the preference shares and stock at the rate of 5 per cent.—leaving a balance of £2405 to the credit of the profit and loss account to be carried forward.

North Middlesex Gas Company.—At the half-yearly meeting of this Company to-morrow, the Directors will report that, compared with the corresponding period of the previous year, the sale of gas in the six months ending the 30th of June increased 2·5 per cent. Favourable contracts have recently been concluded for coal and oil, which enabled the Directors to reduce the price of gas from the 1st of July last by 3d. per 1000 cubic feet, making a total reduction of 5d. since the 1st of January. The sale of 44,210,000 cubic feet of gas produced a revenue of £9397; and the total receipts were £11,976. The expenditure being £9821, the balance carried to the profit and loss account is £2155. The amount available for distribution is £4507, of which the Directors have placed £250 to the credit of an insurance fund; and they recommend dividends for the half year at the rates of 10, 7, and 5 per cent. per annum on the original, ordinary, and preference capital. The payment of these will absorb £2424, and leave £1833 standing at the credit of the profit and loss account.

LEGAL INTELLIGENCE.

Value of Land for a Meter-Testing Station.

At the Guildhall, Westminster, last Tuesday, the High Bailiff (Mr. John Troutbeck) and a Special Jury had before them a claim made by Adams's Trustees against the London County Council for compensation for the compulsory acquisition of land in St. Anne's Street, Westminster, required for the extension of the Council's meter-testing station, owing to the great development of the penny-in-the-slot system. The site was let in 1862 to the Metropolitan Board of Works, the predecessors of the Council; and they held it for a term of 60 years as from Dec. 25, 1862, at a rent of £45 per annum; the lessees undertaking to spend £1500 on a building. There was a total area of 6100 feet, and the site was not dominated by any ancient lights. The lease had 21½ years to run; and the question for the Jury was what was the present value of the unexpired term. Worked out on the usual scale, it would yield £699; but they had to take into account the worth of the reversion. Several experts who had been consulted valued the area at £5970, to which there had to be added 10 per cent. for compulsory sale. These points having been submitted on behalf of the claimants by Mr. Freeman, K.C., Mr. W. H. Southon said he considered the claimants entitled to £7336, and Mr. E. Neild Shackle and Mr. E. H. Bousfield confirmed these figures. Mr. E. Boyle, K.C., for the Council, said the case was an extraordinary one, inasmuch as the same surveyors had said that the highest amount that could possibly be claimed was £5800. He submitted, however, that the land was worth only some £2500 or £2600. Mr. S. Walker considered £2654 the full value; and Mr. J. F. Field agreed with him. The Jury awarded the claimants £5500, including everything.

An Interesting Incandescent Mantle Case.

At the Skipton County Court last Wednesday, His Honour Judge Bompas, K.C., gave judgment in an action brought by Mr. J. Scott Higton, trading as the Skipton Bon Marché, against Mr. John Aldersley, of Skipton, to recover damages for an alleged breach of warranty on the sale of a dozen mantles for incandescent lamps. The mantles were sold for use in the plaintiff's shop; and, while being so used, the Welsbach Incandescent Company gave plaintiff notice that they infringed their patent, and, as there was no discontinuance, they commenced an action for an injunction. After giving defendant notice and eliciting no reply from him, plaintiff settled the action by payment of £5 5s. The whole cost to the plaintiff, including legal expenses, amounted to £13; and it was to recover this sum that the present action was brought. At the original hearing, the question of jurisdiction was raised; and the matter was postponed to enable the Judge to look into the whole facts of the case. His Honour now said he was of opinion that he had jurisdiction. The defendant did not expressly refuse to warrant that the mantles were not an infringement of a patent, though, on the other hand, he very likely avoided giving a personal warranty. He was of opinion that the mantles really infringed the Welsbach patent. But the objection was raised on the part of the defendant that the patent was not valid, and that therefore there could be no infringement of it; and, further, that as the validity of a patent, which is a franchise, thus came into question, his jurisdiction was ousted. This objection he held to be unfounded; and he was of opinion that he had jurisdiction. The patent was valid, and the mantles sold by the defendant to the plaintiff were an infringement of it. The plaintiff, therefore, had no right to sell them, nor could they be lawfully used for the purposes for which they were sold. He thought the plaintiff was entitled to recover the amount of the damages—viz., £13; and he would also certify that, as the action involved a difficult question of law, and one of importance to a large number of persons, the costs would be on the higher scale.

Fraudulent Use of Town's Water.

At the Crewe Police Court, last Tuesday, Mark Evans, T. Bebbington, T. Jones, G. Davies, F. Chamberlain, S. Broad, T. Harrison, and C H. Holmes were charged with fraudulently abstracting and using water of the Local Authority of the borough of Crewe. The allegation of the prosecution was that, on the night of July 10, Benjamin Howarth, a plumber in the service of the Crewe Town Council, went to Sefton Avenue and found that, in an empty house belonging to the defendant Holmes, pipes had been connected with a water-tap in the kitchen, carried through the back for some distance, and laid in a gully which emptied into a pit in a brickyard also belonging to Holmes. The water was flowing at about 160 gallons an hour. At night the pit was empty, and in the morning it was practically full. Mr. Holmes's attention was drawn to the matter; and he said that the connection had been made without his knowledge. Mr. Holmes had applied for a water-meter for the brickyard, but this had not then been put down. Two names were afterwards given to him as men who had connected the pipes. After a long hearing, the charges against Mr. Holmes and Sidney Broad were dismissed. Two of the defendants —Evans and Harrison—were fined 20s. and costs, and Bebbington, Davies, Chamberlain, and Jones were each fined 10s. and costs.

The Water-Works Purchase Question at Portsmouth.—The ratepayers of Portsea Ward have passed a resolution protesting against the acquisition of the water-works by the Portsmouth Corporation.

Gas Profits at Falmouth.—Referring to the annual accounts of the Falmouth Gas Company, noticed last week, a local paper points out that the concern is not such a huge profit-earning success as was alleged some time ago by the advocates of municipalization. In 1896, Mr. Silverthorne estimated that the profits to the town from gas alone would be £2248 per annum; but it has taken until 1901 to reach the output of gas which he calculated would be attained in 1898-9; and now that it is reached, the profits are £700 less than his estimate.

MISCELLANEOUS NEWS.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Annual General Meeting of this Company took place last Tuesday, at the Offices, Duke Street, Liverpool—Sir EDWARD LAWRENCE in the chair.

The Directors' report showed that the total revenue in the year ending June 30 last was £644,345, and the expenditure £531,486; leaving a surplus of £112,859, which had been transferred to the credit of the profit and loss account. After deducting the amount taken for payment of the dividend declared last February, and the interest on the debenture stock, there remained a balance of £50,671.

The CHAIRMAN, in moving the adoption of the report and accounts, said the capital expenditure for the year amounted to £9938. He wished they could do without any addition to their capital; but, unfortunately, like all other concerns of the kind, they were obliged to make some little outlay from time to time. They, however, kept it as low as they could. The revenue statement was not, of course, so satisfactory as that of the previous year and the year 1898-9; but this was easily explained. The price of coal during the past year had been very much higher than for some time; and though the Directors raised the price of gas twelve months ago by 3d. per 1000 cubic feet, it had not quite kept pace with the claims made upon them for payment. The amount paid for materials used in the production of gas came last year to £324,669, against £261,179 the year before, or an increase of £63,490. On the other hand, on the item for repairs and maintenance of works and plant there was a diminution of £16,458. This was accounted for by the fact that last year they had £22,000 outstanding in reference to the new works which had been erected in place of the old ones at Linacre; and as the year was a good one, they had the money, and they paid off the balance. This year, however, there was nothing paid for that account; hence on that item alone there was a reduction of £22,000. Then the shareholders might ask how it was that only £16,500 less was shown. This was accounted for by the fact that the Directors had to replace the retorts in Athol Street with sloping retorts, which gave better results in working. This cost in round numbers about £6000 or £7000. So that in these two items they had the explanation of the difference which appeared there. The purifying materials had cost a little more, owing to the enhanced value of lime. On the wages account also there was an increase of about £2000, due to advances they deemed it expedient to concede to their men. On the item "Repairs, maintenance, and renewal of mains, &c.," there was an exceptional increase of about £4700. The amount under that heading kept pretty regularly at about £10,000; last year, however, it was £14,783. This was accounted for by having to lay an additional main at Fazakerley, in order to meet the requirements of the residents for greater pressure of gas. With regard to the credit side of the account, the additional 3d. put upon the price of gas realized an excess of £36,272 for the year. The residual products showed an equally satisfactory result. Coke had produced £14,523 more, and tar £1316 more, than before. There was, however, a slight decrease in ammoniacal liquor—£2097. The net result was a balance of £112,859; but from this had to be deducted £12,654 for the debenture and general interest. This left for the whole year £100,205 profit; and as they required for their dividend £106,367, the year's working left them short of the dividend by £6162. Fortunately, however, they had a balance from the previous year of £3649, so that the deficiency was reduced to £2513. He thought that, as they had to pay so high a price for coal, they ought not to be dissatisfied. With regard to the manufacture of gas, the consumption by private tenants was 3050 million cubic feet, against 3112 millions in the previous year—a decrease equal to 1·99 per cent. The automatic meters showed a consumption of 203 millions, against 176 millions—an increase of 15·47 per cent. The public lamps showed a reduction—225 millions, against 230 millions, or a decrease of 2·23 per cent.; the total being a net decrease of 1·13 per cent. on the year. Of course, one expected a smaller consumption last year. It was rare for the Company to have a balance to the bad, and in very few years in the course of their existence had this occurred; but there it was for the past year, and they might be satisfied that the deficiency was so very small, as many other companies had to report a much larger one. He had to regret that they were not able to announce a reduction in the price of gas. At one time he had thought it might be possible, or even probable. But they could not control the course of events; and when it came to balancing the accounts for the year, it was found better to leave the matter of reduction alone for the present. They might ask how that was, seeing that coal and oil were cheaper. The Directors estimated that the cost of materials for use during the present year would be nearly £32,000 less than for the period under review; but he was sorry to say that the estimate for the sale of residuals showed a deficiency in the coming year of £26,000. Therefore there was only a balance of £6000, or just enough to provide for the dividend. The Directors were disappointed that they had been unable to buy coal at lower rates; but their contracts were made at almost uniformly 2s. 6d. per ton below the previous year. With regard to cannel, he was sorry to say that in the great majority of contracts there was no reduction whatever. They had thus had to pay the same prices as in the previous year, except for a small lot, on which there was a reduction of 1s. 9d. a ton. Oil, however, showed a considerable fall. There were the figures, and they could not alter them. The Directors had done the best thing they could for the Company and for the public. He hoped, however, that before very long they would see their way to making some reduction in the price of gas. They were starting the year in one way more favourably; for whereas during the greater part of the past year, and certainly for the last half, they were showing a diminished production, they had begun this year with a considerable increase, and up to the present he thought their make of gas showed an advance of between 4 and 4½ per cent. upon the past year. Of course, this was a "small" time of the year when the quantity of gas made was comparatively low; but still it indicated what was going on. The consumption at

this time last year was large for the period; but, in spite of that, they showed the increase stated over and above what they were then producing. He thought they had every reason to hope they were entering on a happier condition of things from a mercantile point of view. The shareholders knew that last year there was a sort of collapse after the time of prosperity that accompanied the first year of the war; but things were now looking better, though they still hoped to see many prices lower than they were at present. There was a greater demand springing up; and if they could get rid of the burden of the war in South Africa, he thought they would see a very material advancement in the commerce of the country, and this would be reflected in the prospects of the Company as much as it would be anywhere else. Mr. King (the Engineer) asked him to say that the reduction in the consumption of gas was almost entirely due to the extraordinary warm weather last December. To a certain extent, of course, this was so; but they always found when the price of gas had to be raised the consumption was checked, and there was no doubt that to a certain extent this was the cause of the reduction in their consumption last year. They might now have a mild winter or a severe winter; they could not tell. But he was quite certain that if they could manage to reduce the price of gas, it would make a difference in consumption, and tend to bring about what they wanted, which was to lower the cost of gas; because when once they increased the consumption of gas they reduced the cost of production. The works had been kept in the highest state of efficiency, and the working of the Company during the past year had been everything they could desire. The production of the different articles manufactured from coal, or whatever it might be, showed as good results as in the past; in some cases they were even better. He thought the shareholders would feel perfectly satisfied that their property had suffered no deterioration, but had maintained the high position it had so long held. Of course, they had to face, and always would have to face, the increasing competition of the electric light; but he saw nothing to cause any anxiety or alarm on their part. They were going on with the consumption of gas in various ways; and if a number of people used electric light instead of gas, there were other means of using gas which were constantly coming into operation, and its consumption was steadily increasing. So it had been in the past, and so, he believed, as far as they could see, it would be in the future. At all events, there was no indication of any change likely to occur in that respect; and he hoped the shareholders would feel that the Directors had watched over their interests, and had done everything they could to promote the welfare of the Company.

The Deputy-Chairman (Mr. J. Lister) seconded the motion, and the report was adopted.

It was then resolved that a dividend for the past half year ending June 30 be declared of £5 per cent. on the ordinary consolidated ("A") stock, and of 3½ per cent. on the 7 per cent. ("B") stock.

In reply to questions, shareholders were informed that the leakage of gas was 5¾ per cent., and that the matter of erecting a sulphate of ammonia plant had been considered by the Board, and rejected. These replies were pronounced satisfactory.

The Chairman and Board were then thanked for their efficient services; and the proceedings closed.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Ordinary General Meeting of this Company was held last Saturday, at the new offices in the High Road, Tottenham. In the absence of Mr. Corbet Woodall, Mr. D. Ford Goddard, M.P., the Deputy-Chairman, presided.

The Secretary (Mr. James Randall) having read the notice convening the meeting, the Directors' report and the accounts were taken as read. The former showed that the quantity of gas sold during the half year had increased by 16¾ millions, or nearly 6 per cent., and that on the profit and loss account there was a balance of £7236, which fell short by £624 of the sum necessary to pay the dividend. The receipts on revenue account were £64,067; and the total expenditure £54,487—the balance being £9579.

The Chairman said he ought to explain that their respected Chairman (Mr. Corbet Woodall) was taking a much required holiday after a long parliamentary session, during which he had had a great deal of heavy work. He was away from England at the present time; and he desired him (Mr. Goddard) to apologize for his absence. Under these circumstances, he, as Deputy-Chairman, had to move the adoption of the report and accounts. On this occasion, a long speech was not required of him; but there were a few points upon which he might remark, and which he thought would be interesting. First of all, he would say that it had been abundantly proved that it was necessary for the Directors to increase the charge for gas the last half year, on account of the tremendous rise in the price of coal. They advanced the price, as the proprietors were aware, by 4d. per 1000 cubic feet; and the best proof that they did not go beyond what was absolutely necessary was found in the fact that the balance which they carried to profit and loss account was not quite sufficient to meet the dividend for the half year. A paragraph in the report expressly stated that the price of gas was raised solely on account of the high cost of coal. Therefore, as the price of coal was now going down somewhat, it was not anticipated that the increased price would continue beyond Christmas. He thought this would be good news. It was not the intention, nor was it the policy, of the Board to ask a high price for gas. They realized that the Company's business depended upon selling a good article at a reasonable figure, and nothing but the necessity of the hour would have obliged them to raise the charge. During the half year, they had worked under certain difficulties—difficulties that had been growing upon them for some time, and difficulties which, he ventured to think, would, from the proprietors' point of view, be regarded with a good deal of equanimity. These difficulties arose from the continuance of the large increase in their business. Everybody liked to see an increase in his business; it looked prosperous and well. The Company had been in that position now for a considerable time. The district over which they administered the supply of light was constantly growing; and so were the demands upon the Company. The result was that their plant had had to be worked at high pressure; and they found it absolutely necessary to extend it in order to meet the growing demands of the neighbourhood. He pointed this out to the proprietors because he considered it an important matter. It made plain some things in the balance-sheet which would require explanation. It showed, for example, very fully why the Board were obliged to ask the proprietors for more capital to carry on this prosperous undertaking. He might point this out, that in 1898 they had an increase over the preceding year of 8·36 per cent. That was a large increase in an ordinary business; but in 1899 they had a larger growth—10·48 per cent. In 1900, there was a still greater increase—13·32 per cent. Now this showed not only a growing increase, but quite an abnormal one. The proprietors must not go on expecting such an advance as this, because it would be unreasonable, and he was not sure that it was altogether desirable. In the past six months, they had made an increase of nearly 6 per cent. on the corresponding period of last year; so that it was clear their business was a growing one. It might be of interest if he were to point out that the increase was not merely a large one, but it was a substantial one; and it was one the proprietors ought to regard with great favour, because it was spread over a considerable number of consumers, and had not been brought about by a few large customers. The number of ordinary meters in use in 1898 was 7119; in 1899, it had risen to 7901; in 1900, to 8627; and at the present time it was nearly 9000. These figures disclosed a continuous growth of business which was very good for their undertaking. Perhaps, however, the most remarkable development of the gas industry of late years was that which had been brought about by the use of slot meters; and the Tottenham Company, like all other gas companies, had largely shared in the increase due to this cause. In 1898, they had 7024 slot meters in use; in 1899, they had 8082 (over 1000 increase on the year); and in 1900, they had 9048 (almost another 1000 increase). This meant that they were at present selling gas to a class of consumer who never used it before; and they were selling it to consumers who would scarcely be in a position to use the electric light, even if it were to be available in the district. Therefore they were producing now a consumer of their commodity who was likely to be a permanent and regular one, and upon whom the Company could thoroughly rely. It was rather interesting to note the enormous sum of money that accrued to gas companies from such small means as these slot meters. The great bulk of the meters used in their district were penny-in-the-slot meters; but there were a few for coins of larger value. The total amount of coin taken from the meter-boxes for the year ending on June 30 last, was £23,663 odd. This was an enormous sum of money; and when it was remembered that a comparatively few years ago none of these people were consumers of gas, it would be seen how much this system had enlarged their business and made it of a regular and permanent character. There were many other ways in which he could show the proprietors how the business was steadily growing. One of its most important features, and one to be relied upon and encouraged, was the growth of the use of both heating and cooking stoves; and, in this respect, they were continually showing a large growth. At the present time, they had 3457 stoves in use, which was an increase of 360 since the corresponding meeting of last year. This growth had been constant and steady also. However, it all meant that they could not carry on the business with the old plant. As the business extended, so they must spend more money in developing the works. Therefore, at the present time, they were looking forward to this increase. They were building a new gasholder, which, when completed, would have a capacity of 3 million cubic feet. The tank was in course of construction, and the drawings for the holder had been prepared; and in about a year from this time, the Directors hoped that the holder would be completed and ready for use. They had likewise got in the foundations of a new retort-house, which had become necessary on account of the growth of the business; and in many other directions they had had to extend the plant. It all pointed to this: They could not—it was impossible—work under the most economical conditions when they were constantly increasing the capital account; and therefore perhaps at the present time they did not compare so favourably in some respects as they might do. But he could fairly say there was good reason for calling up fresh capital, and there was every reason to believe that the capital would be remunerative. He ought to say a few words about the new offices in which the proprietors were meeting for the first time that day. It had become necessary, with such a growing business, that they should have a more central position for their work than the old offices in Willoughby Lane. The latter were too far away from their clients; it was not easy to deal with complaints; they could not show the consumers the most modern improvements in gas appliances; nor could they carry on their business so profitably when they were so far away. Some of the proprietors might think the Directors were spending a large sum of money on these new premises. That was so; but the Directors believed it would be a profitable expenditure, as it would enable them to carry on their work to greater advantage. It would be seen that the profit was not quite sufficient to pay the whole of the dividend; and the Directors had been obliged to draw upon the reserve fund to the extent of £624. Well, he might say this for the encouragement of the proprietors, that the price of coal had become lower, and for the next year the Directors had made contracts which were very much more favourable than those which were made last. Further, the stocks that had been taken of the coal in hand, which were very large, were exceedingly fair. They had been taken on a fair and low basis. Indeed, he believed they could sell the coal at over the price they had taken the stocks at; and so they started the half year with a very good supply at a low value. Therefore he did not think the deficit he referred to would recur.

Mr. H. Bailey seconded the motion, which was unanimously carried.

Mr. G. T. Watson moved the declaration of dividends at the rate of 5½ per cent. on the "A" stock and 4 per cent. on the "B" stock. He mentioned that this was the first time since the Company came under the sliding-scale that they had to announce a decrease in the dividend. He should be greatly surprised if they were not in a position to revert to their previous dividend, and to show a greatly improved condition of things, in their next accounts.

Mr. A. W. OKE seconded the motion, which was unanimously carried.

The retiring Directors (Mr. Corbet Woodall and Mr. James Warren) and Auditor (Mr. Edward Crowne) were unanimously re-elected.

The CHAIRMAN having paid a handsome tribute to the work of the Engineer (Mr. A. E. Broadberry), the Secretary (Mr. James Randall), and their respective staffs, a vote of thanks was passed to them and to the Chairman and Directors, on the proposition of Mr. J. CLOUDSLEY, seconded by Mr. J. L. CHAPMAN.

This concluded the proceedings.

The new offices were afterwards inspected by several of the proprietors. They are large, and have been specially planned to meet the requirements of the business. The building forms quite an imposing feature of the High Street of Tottenham. The Company are to be congratulated upon their enterprise; and the district upon having a Company in their midst who have shown their willingness to add to the attractions of the place in such a liberal manner.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. CHARLES HORSLEY, J.P., in the chair.

The SECRETARY (Mr. Ernest W. Drew) having read the notice calling the meeting,

The CHAIRMAN moved the adoption of the report and accounts. In doing so, he first dealt with one part of the report, which, he said, was not on the face quite consistent with another part. It showed that the Directors proposed a reduction at the rate of 1 per cent. in the dividend; and yet they stated, in a succeeding paragraph, that the business continued to progress. The profit on water had increased by £824; but for gas there was a decrease—arising not from the private consumers, but from public lighting. As a matter of fact, there was an increase on the private consumption. They had added £500 to the renewals as usual; and coal had cost an additional £895. Then pumping had cost an extra amount, through their machinery not being down yet at Potters Bar; and this, with the water which they took from the New River Company represented an additional charge of £948. Next year the water at Potters Bar would be pumped by their own machinery, which, being more economical than that which they had been temporarily using, would lessen the cost of pumping. Therefore, in view of all this additional expenditure, the Directors had decided that, instead of paying the same dividend as last time, they would ask the shareholders to take less, and then to wait a little—perhaps not more than twelve months, by which time, he felt sure, they would be able to restore the 1 per cent. The profits of the half year would have been short of the amount required to pay the same dividend as previously; but by paying the 1 per cent. less, they would have £396 to carry forward. He hoped the shareholders would approve of this, because it was really a sound policy to pay their way, so far as they could, out of the profits earned in the period to which the dividend referred. They had on the previous occasion to draw rather a large sum from their undivided balance; and he did not want to do so again if it could possibly be avoided. The Board were perfectly agreed as to the wisdom of this. He referred with satisfaction to the water supply of the district during the present summer. Regarding the new well at East Barnet, they were getting above 1 million gallons a day, although they had not yet got down to the adits, the contracts for driving which had been entered into. The Directors were also making arrangements for another new well, the cost of which would be a capital outlay; and they were also building a new reservoir to hold 1¾ million gallons. Turning to the working results of the gas undertaking, he informed the shareholders that the quantity of coal carbonized was 4372 tons, which was a decrease of 48 tons—this being due to the loss (which he had explained) of a certain amount of rental for public lighting. Their coal cost an average of £1 1s. 5¼d. per ton, against 17s. 2d. per ton in the corresponding period of last year. In the amount of gas made, there was a decrease of 489,000 cubic feet, also due to the reduction of the public gas lighting in the district. The amount of gas made per ton was 10,987 cubic feet, which was very good. The quantity sold showed a decrease of 431,000 cubic feet; and the unaccounted-for gas was equal to 7·04 per cent. As to the residuals, the average price obtained for coke was 13s. 9d., against 11s. 6d. The tar made was equal to 14 gallons per ton of coal carbonized; and the price received was 1½d. per gallon. The quantity of sulphate of ammonia produced was 45 tons; and it had gone down in price from £8 1s. 3d. to £6 9s. 5d. Regarding the gas revenue account, the sale of gas had produced £631 more, and residuals £368—together £999. The additional cost of coal, however, had been £895; and the working expenses had increased by £584—or, together, £1479. Deducting the increased receipts from the increased expenditure, they had a reduced profit of £480. But on the water they had an increase of £824. After paying the proposed dividend from the half-year's profits, they would, as he had said, have a balance of £396 to carry forward.

Mr. A. H. BAYNES seconded the motion, observing that he wished to accentuate the paragraph in the report which stated that the business of the Company continued to progress. That was absolutely true. He believed the Company never occupied so good a position as it did to-day. The mere set-back in the dividend was due to exceptional and temporary causes; but, with the Chairman, he believed that in twelve months' time they would be back again in the position they previously occupied.

Mr. R. JOHNSON sought an explanation of the figures in the profit and loss account, and elicited from the Chairman that, in addition to the £396 which would be carried forward, the amount of undivided profit in hand was £6424.

Mr. DYER commented upon the baldness of the report; and he failed to see that the statement "the business of the Company continues to progress" was compatible with the reduction of 431,000 cubic feet in the sale of gas. He expressed alarm at the rate of increase in the capital account; but he acquiesced in the proposal, under the circumstances, to reduce the dividend. He disclaimed any intention of attacking the working of the concern, because he knew that in their Engineer (Mr. T. H. Martin) they had one of the first gas and water engineers of the day; but it was the policy of the Board that he attacked. He protested against the Directors selling water shares in December last (for which a good premium was obtained), and then so soon afterwards reducing the dividend. He inquired whether the Directors had increased the price of gas in proportion to the increased cost of coal; and he thought that the Directors' fees, which ascended by £100 for every 1 per cent. increase in dividend, ought to descend in the same ratio when the dividend was reduced.

The CHAIRMAN, in reply, said the price of gas was increased 4d., which was nearly in proportion to the rise in the price of coal. They might perhaps have made it 2d. more; but the Directors considered the residuals would make up the difference. As to capital outlay, that never came to an end in the case of a water company; and he must say that, by their expenditure, they were putting themselves in a very good position in regard to the water supply. As to the Directors' fees, the present arrangement was come to some ten years since. He could not say offhand the exact terms of the resolution; but whatever they were they would be adhered to.

Mr. F. LENNARD pointed out the unusual circumstances of the past year; and he believed that twelve months hence it would be found that the saving on coal and in the pumping charges would restore the Company to the level of prosperity that it previously occupied.

Mr. ALFRED LASS having given further explanations, the motion was adopted.

A dividend at the rate of 7 per cent. per annum on the "A" and "C" stocks, 6 per cent. on the "B" stock, and £4 18s. per cent. on the "D" capital having been declared,

The usual votes thanking the Chairman and Directors and the several officers were duly passed and acknowledged.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

At the half-yearly general meeting of the Altrincham Gas Company to-day, the accounts to be presented will show a total revenue for the six months ending the 30th of June of £14,091, of which £10,552 is for gas sold for private lighting. The expenditure was £10,591; and the balance carried to the profit and loss account is £3500. The Directors, in their report, point with satisfaction to the fact that though the additional expenditure occasioned by the high price of coal amounted to more than £1860, they were able to make this profit without increasing the price of gas; and, with £405 taken from the balance brought forward, all fixed charges can be met, and the full statutory dividends paid, with £420 to the good. Under the supervision of the Manager (Mr. J. E. Lamb), 5387 tons of coal and 2370 tons of cannel were carbonized in the past half year; the quantity of gas sold being 75,471,481 cubic feet.

In the report which the Directors of the Bath Gas Company will present at the half-yearly general meeting next Friday, they state that the quantity of gas sold in the six months ending June 30 was about the same as that of the corresponding period of last year. The receipts amounted to £44,201; the expenditure to £39,025—leaving a profit of £5176, compared with £8449 this time last year. The reduction is attributed to the sales of gas not having increased, together with a large falling off in the returns from residuals and an increase in expenditure. Taking the revenue accounts for the entire year ended the 30th of June, the profit is sufficient to pay the maximum dividends; and the Directors will recommend their declaration. The shareholders are to be asked to sanction the raising of additional capital under the powers of the Company's Act of the past session.

At the half-yearly meeting of the Bedford Gas Company, the Rev. Paul W. Wyatt (the Chairman) presided, and congratulated the proprietors on the fact that they had tided over a difficult year without raising the price of gas to the general public. The total number of consumers at present was 3500, and prepayment meters were rapidly growing in popularity. The increase in consumption exceeded the average of the last five years, and the manufacture of gas for the past six months amounted to 86,109,000 cubic feet. The works had been fully maintained, and the following extensions were on order: A gasholder to contain 462,000 cubic feet, a main under the Ouse to increase the supply to the south side of the borough and to Kempston, and plant for the manufacture of sulphate of ammonia, for which manure there was a strong demand in their agricultural district. Coal contracts had been entered into at a considerable reduction, though not equal to the hopes of the Manager (Mr. T. Dann). The Directors expected to be able to make a further reduction of 1d. per 1000 cubic feet in the price of gas from Dec. 31 next. It was stated as an interesting fact that, taking the standard price allowed by the Company's Acts of Parliament at 3s. 6d., and the standard dividend at 7 per cent., the consumers now benefit to the large figure of £5250 per annum, in addition to the low charge to the town for the public lighting; while the shareholders only receive £983 extra dividend per annum.

In the half year ending June 30, there was an increase of upwards of 3 per cent. in the consumption of gas in the district of the Dover Gas Company. The total revenue in that period amounted to £24,375; the expenditure to £22,601—leaving a balance of £1774 to be carried to the profit and loss account. The sum required for the usual dividend of 7½ per cent. is £2837, and the balance on the profit and loss account is only £1593; so that £1244 is needed to make up the deficiency. The Directors recommend that this sum should be taken from the reserve fund. The Directors have entered into a contract for the supply of the principal part of their coal for the current year, at a considerable reduction from last year's prices. They have good reason, therefore, to anticipate the replacement of the above-named sum at an early date, with a subsequent reduction in the price of gas. Under the supervision of Mr. R. Herring, 11,166 tons of coal and 7316 gallons of oil were used in the production of gas, of which 113,083,700 cubic feet were sold for public and private lighting; producing a net revenue of £17,093.

The report of the Directors of the Hartlepool Gas and Water Company for the year ended June 30, sets forth that the balance of revenue

account carried to profit and loss amounts to £26,060, of which £13,942 has been paid as interim dividend, and £2875 as interest on loans. The Directors recommend the payment of a dividend for the past half year at the rate of 5 per cent. per annum, less income-tax. The large deficiency in the divisible revenue is attributable chiefly to the heavy parliamentary costs incurred in opposing the Bill promoted unsuccessfully by the Corporations of Hartlepool and West Hartlepool, for the compulsory purchase of the Company's undertaking, and also to the high price paid for coal. To meet this deficiency, a considerable draft upon the balance available for such a contingency has been necessitated.

The accounts of the Brighton and Hove Gas Company for the six months ended June 30, 1901, which the Directors will submit at the half-yearly general meeting on the 6th prox., present some features which are exceptional. The quantity of gas sold was slightly less (2·77 per cent.) than for the corresponding period of last year. The income from this source was, however, £11,698 more—the result of the advance in price. The value of residuals was less by £3129. The new wood paving of some of the streets in Brighton, and the construction of electric tramways, made partial relaying of the Company's mains necessary; and a large revenue expenditure was thereby incurred. The Directors also deemed it wise to expend more than usual upon the repair and maintenance of works, notably upon the sea defences at Portslade. The revenue for the half year was £115,883; the expenditure, £100,701—leaving £15,182 to go to the profit and loss account. The balance of profit brought forward was £4009; making together £19,191. After paying interest charges, there remains a balance of £16,403 available for distribution. The Directors recommend the declaration of dividends for the half year at the standard rates—viz., 10 per cent. per annum on the original ordinary consolidated stock, 7 per cent. per annum on the "A" ordinary consolidated stock, 6 per cent. per annum on the "B," and 4 per cent. per annum on the "C" preference consolidated stock. For the payment of these dividends, £21,204 is required; and it will, therefore, be necessary to take £4801 from the reserve fund, which will leave £66,724 to be carried forward. Under the supervision of Mr. Joseph Cash, 37,328 tons of coal, 830 tons of cannel, and 479,808 gallons of enriching oil were employed in the manufacture of gas, of which 526,733,300 cubic feet were sold for private, and 17,440,700 cubic feet for public lighting.

At the half-yearly general meeting of the Keswick Gas Company next Tuesday, the Directors will report that, after allowing for depreciation of cookers and for bad debts, the revenue account shows a credit balance of £1141 on the working in the year ending June 30 last. Deducting from this amount £68 paid for income-tax and £80 interest on loans, there remains a sum of £993. The Directors propose a dividend at the rate of 8½ per cent. per annum on the original capital, and at the rate of £5 19s. per cent. per annum on the additional capital. This will absorb £846; leaving £147 to go to the net revenue account. The expenditure in the year was £3008; the revenue, £4150.

The half-yearly meeting of the Kingston Gas Company was held a few days ago, under the presidency of Mr. Bedford Marsh, J.P. The report presented stated that there had been a very satisfactory increase in the quantity of gas sold, and that the carburetted water-gas plant was working well. In moving the adoption of the report, the Chairman said the new plant referred to had cost about £21,000; and it enabled them to increase the output of gas by 1¾ million cubic feet daily. The plant was worked at far less cost than the old method; and had it not been provided, they must have installed a new set of retorts. Referring to the expenditure on the new offices in the course of erection in Thames Street, he remarked that the business to be done demanded more room than they had before, and on the new premises ample space would be found for a show-room, which would be a great advantage. The report and statement of accounts were adopted; and a dividend at the rate of 5 per cent. upon the consolidated ordinary stock was declared. A proposition to increase the allowance to the Directors from £150 to £250 a year each was carried; and the usual vote of thanks closed the business.

The report of the Directors of the Normanton Gas Company for the half year ending June 30 states that the profits for the six months amount to £1045. The sum available for distribution, after providing interest on mortgages, amounts to £2732, out of which the Directors recommend the payment of dividends of 5½ per cent. on the original stock and 4 per cent. on the additional stock.

The half-yearly general meeting of the Portsea Island Gas Company was held last Saturday—Alderman Sir John Baker presiding. In moving the adoption of the report, noticed last week, the Chairman observed that the full printed statements which the shareholders held spoke for themselves, and needed but little observation from him. Their business had progressed as satisfactorily as in former times; they had obtained their new Provisional Order without any difficulty; and the easy disposal of the 200 new shares recently offered by tender was a fact that the greatest trust was placed in the undertaking. The capital was thus provided for their proposed new works at Gatcombe, which would not be hurriedly carried out, but would yet be undertaken without delay. In two or three years they would have means for providing an ample supply of gas for a long time to come. If anything needed justification for the course they had taken, it was the fact that during the year ended the 30th of June the Company had obtained an addition of 648 ordinary and 3028 automatic consumers; while the cookers on hire had increased from 9257 in 1900 to 13,191 in June, 1901. He concluded by highly commending the Company's staff, and said that during the past six months the bad debts incurred amounted to only £96. Alderman Sir W. D. King seconded the motion, and it was carried unanimously.

At the half-yearly general meeting of the Reading Gas Company to-day, the accounts to be presented for the six months ending June 30 show that the sale of 174,377,300 cubic feet of gas within, and 6,898,100 cubic feet beyond the borough, produced a revenue of £26,301; while that consumed in the public lamps brought in £2135. The sale of residuals yielded £11,626; and the total receipts were £40,115. The expenditure on the manufacture of gas was £27,568; on distribution, £2112; and on management, £1422—the total outlay being £33,602. The balance carried to the profit and loss account is £6513; and the amount available for distribution, £21,179. The Directors recommend the payment of the full dividends on all the stocks and shares. Under the supervision of the Company's Engineer (Mr. Herbert E. S. Baker), a sum of £12,853 was expended in the half year on new buildings and plant; bringing up to £201,060 the capital outlay on the undertaking. The show-rooms lately constructed are now open.

A profit of £1516 was made by the Tamworth Gas Company in the past half year; and dividends at the rates of 10 and 7 per cent. have been declared. The sale of gas increased by 4 per cent. Having placed their coal contracts at a reduced rate, the Directors have determined that the 5d. per 1000 cubic feet which was added to the price of gas last year shall be removed as from Sept. 30 next.

The annual meeting of the Taunton Gas Company was held last Tuesday—Mr. Jonathan Barrett, the Chairman, presiding. The Directors in their report stated that the quantity of gas sent out during the year was 74,859,000 cubic feet. The amount available for distribution was £3703, out of which the Directors recommended dividends of 5, 8, and 7 per cent. on the different stocks. These payments would amount to £3275, leaving a balance of £428 to be carried forward, against £882 last year. In moving the adoption of the report, the Chairman congratulated the shareholders on the way in which the Company had gone through the year, which had, he said, been a trying one, on account of the high price of coal. In spite of this, he thought the report would be considered as thoroughly satisfactory. After so mild a winter as the last, they had no reason to complain of the quantity of gas sent out, which was 1,503,000 cubic feet more than in the previous year. The only loss the consumers suffered was that of a discount, which averaged about 2d. per 1000 cubic feet; whereas most of the gas companies in the country had raised the price of gas 5d. or 6d. The report was adopted, and the dividends were declared. The retiring Directors and Auditors having been re-elected, the Engineer and Secretary (Mr. A. Edwards) and the staff were heartily thanked for the able way in which they had conducted the business of the Company during the twelve months; and Mr. Edwards suitably acknowledged the compliment. A vote of thanks to the Chairman brought the annual meeting to a close. A special general meeting was then held, at which authority was given for raising £5000 of additional capital (part of the £40,000 sanctioned by the Company's Act of 1897), at a standard rate of dividend of 7 per cent. per annum, which is required for the extension of mains and the provision of meters and stoves.

At the recent ordinary half-yearly meeting of the Tunbridge Wells Gas Company, the Chairman (Alderman W. H. Delves, the Mayor), stated that the Company had been able to maintain their position satisfactorily, although it was a matter of regret that they could not show much of an increase in the sale of gas. The continued popularity of the prepayment system was evidenced by the sales during the half year; and the income from this source was in all respects gratifying. The Company could congratulate themselves upon the fact that they had not been obliged to raise the price of gas, as a good many other companies had been compelled to do, on account of the increased cost of coal and other materials. The usual interim dividends at the rates of 11½, 9, and 8½ per cent. per annum were declared for the half year.

At the meeting of the Waltham Abbey and Cheshunt Gas Company next Friday, the Directors will report that the rate of increase in the sales of gas and residuals were well maintained in the six months ending the 30th of June, compared with the corresponding period of last year. The accounts show that the revenue from the first-named source was £4066, against £3891, and from the second £1367, against £1068; the total receipts being £5819. As the expenditure was £4167, there was at the close of the half year a balance of £1652 to be carried to the net revenue account, compared with £1606 this time last year. The sum available for distribution is £2601; and the Directors recommend dividends at the rate of 8 per cent. per annum on the "A" shares, and of 6 per cent. per annum on the "B" and "C" shares. These, with the debenture and stock interest will require £1648, and leave a balance of £953 to be carried forward. Under the supervision of the Engineer and Secretary (Mr. W. Bince Randall), 2383 tons of coal were employed in the manufacture of 24,169,000 cubic feet of gas, of which 22,863,000 cubic feet were accounted for. The figures for the first half of last year were: Coals, 2043 tons; make of gas, 21,515,000 cubic feet; gas accounted for, 21,114,000 cubic feet. The carbonizing plant has been extended by an installation of oil gas apparatus.

At the meeting of the Wellingborough Gas Company yesterday, the Directors reported that the business of the Company was in a most satisfactory condition. The quantity of gas sold in the half year ending June 30 was nearly 20 per cent. greater than in the corresponding half of the previous year, and 555 more meters were in use. This was a larger increase than at any previous period since the foundation of the Company; and it was owing to a great extent to the more extended use of gas cooking-stoves. The Company had 1160 of these out on hire on the 30th of June, and upwards of 100 had been fixed since that date. The quantity of gas sold was 56,135,853 cubic feet, which produced (with a sum of £36 8s. 6d. of unclaimed discounts) £7847. The total receipts were £10,753; the expenditure was £8759—the balance carried to the profit and loss account being £1994. The profit earned in the half year was not enough to meet the full amount of charges for dividends and interest; but there was a sufficient balance on the profit and loss account to justify the Directors in recommending the usual dividends—viz., 6 per cent. on the "A" and "B" shares, and 4½ per cent. on the "C" shares (income-tax paid).

The report of the Directors of the Wolverhampton Gas Company for the half year ended June 30 last, to be submitted at the meeting to-day, sets forth that there is a net profit of £7525. This added to the balance from the previous half year enables the Directors to recommend the payment of dividends of 3 per cent. upon the preference and new ordinary stock and 5 per cent. upon the consolidated stock. They further recommend that £143 should be placed to the credit of the reserve fund, and £40 to the credit of the insurance fund, and that the balance should be carried forward.

Water Companies.

The 43rd annual general meeting of the Brymbo Water Company was held last Tuesday, at Wrexham—Sir Theodore Martin, K.C.B., in

the chair. The Directors, in their report, stated that during the past financial year, 51 additional houses had been connected with the Company's mains; making the total number supplied 3542. The domestic supply accounts showed an increase of £62 13s. on the previous year; and those referring to trade supplies, an increase of £162 4s. 2d. The balance from last year's account was £116. The net revenue receipts for the year were £2191 16s. 4½d.; the total receipts, £2308. Deducting the interim dividend at the rate of 4 per cent., paid in March, and the interest on debentures and loans, there remains available for dividend £963. The Directors recommend that a dividend at the rate of 4 per cent. per annum should be declared for the second half year (free of income-tax), and that £23 be carried to the credit of next year's account. The report was adopted.

At the half-yearly meeting of the Exmouth Water Company last Tuesday—Mr. J. Foster in the chair—it was announced that the profits of the Company for the half year ending June 30 allowed of the maximum dividends of 10, 7, and 5 per cent. being declared, and of a balance of £12 18s. 2d. being carried forward. The Chairman said the resources of the Company had been very severely taxed lately, owing to the dry weather; but the Company had been able to give 33 gallons per head per day to a population of 12,000, which was far in excess of most towns in England. The Directors' report was adopted.

At the recent half-yearly meeting of the Frimley and Farnborough District Water Company, the Chairman (Mr. A. C. Pain) stated that there had been a satisfactory growth of revenue of various classes, and the dividend the Directors proposed to pay was the same as in the previous half year. The mains had been extended 14¾ miles; and, in view of the continual growth of the business, the Board had decided to duplicate the engine, boiler, and well at Itchell. They had also arranged to buy from the Wey Valley Water Company their moiety of the present joint undertaking. The Directors had received an Order from the Board of Trade empowering the Company to raise additional capital. The report and accounts were adopted; and a dividend for the half year at the rate of 5 per cent. per annum was declared.

At the recent annual general meeting of the Wrexham Water Company, the Directors reported that the receipts on revenue account for the year ending June 30 showed an increase of £39, compared with the preceding twelve months. During the year, water had been laid on to 45 houses; making a total of 5558 houses supplied. After payment of the usual charges, the full dividends upon the preference shares and stock, the interim dividends at 7 per cent. per annum upon the consolidated stock, and £4 18s. per cent. per annum upon the ordinary shares for the half year ended Dec. 31 last, and interest upon mortgages and debenture stock for the year, a balance of £5745 remained on the net revenue account. The Directors accordingly recommended the payment of the full preference dividends, and dividends at the rate of 7 per cent. per annum upon the consolidated stock, and of £4 18s. per cent. per annum upon the ordinary shares, all free of income-tax. The Chairman (Mr. W. J. Sisson), in moving the adoption of the report, referred in detail to the expenditure upon the works; one item of £600 being in respect of the purchase of a farm, with a house and buildings, situated near the intake of the Cae Llwyd reservoir. He said that for some considerable time past the Directors had endeavoured to obtain the control of all cultivated lands adjacent to the main storage reservoir; and, with the conclusion of this purchase, they had removed all possibility of contamination reaching the water. Having dealt with other items in the accounts, the motion was carried, and the dividends recommended were declared. Among the complimentary votes of thanks was one to the Engineer and Secretary (Mr. F. Storr), for the assiduity with which he carried out his duties. Mr. Storr, in responding, thanked the shareholders for their renewed confidence in him. He said it was now nearly thirty years since he assumed the direction, under the Board, of the Company, which had grown from a capital of £15,000 or £18,000 to one almost ten times as much; and during the whole of that period he had been supported and cordially helped by the Board and the shareholders.

GAS COOKING-STOVES AT MORECAMBE.

At the last Monthly Meeting of the Morecambe Urban District Council, a long and somewhat excited discussion took place in regard to the action of the Gas Committee in recommending the purchase of 125 additional cooking-stoves with slot meters. The Chairman of the Committee (Mr. R. B. Abbott) explained that, of the 50 stoves which had already been fixed, some had only been in operation two or three days; but in order to get a basis to work upon, he had taken 30 of this 50, which had, on an average, been in use 22 days. He might say that they had received 163 applications for meters and cookers, and this was the reason why it had been resolved that a further supply of 125 should be obtained. Those who had applied and been supplied were absolutely new consumers; and the 30 cookers had been fixed in various parts of the town and for all classes of householders. The average outlay on each had been £4 18s., which was 3s. over the Engineer's estimate, accounted for chiefly by the extra length of compo. required. The average consumption for each cooker per week was 323 cubic feet, which would be 16,800 cubic feet per annum, or £3 10s. Calculating that the production of the gas, including management charges, cost them 1s. 7d. per 1000 cubic feet, this meant a net revenue of £2 3s. 5d. from the cookers, or 44 per cent. on the outlay. After giving further figures, with the view of proving the profitable investment the cookers would turn out to be, he said all this should be an incentive to the Council to go in for more of them. There were something like 400 non-consumers of gas in the town, and if they could be induced to adopt slot cookers, they would provide an additional source of revenue for the town. He moved the adoption of the minutes of the Gas Committee containing the recommendation. Mr. Brear, in seconding the motion, said he was satisfied, from what he had seen of the cookers, that they would prove a paying investment. If they could get 200 more gas consumers, they must necessarily add to the income of the town. After allowing 15 per cent. for depreciation, there would be a good profit

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 502.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 12	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	May 15	6½	Bombay, Ltd. . . .	6—6⅜	..	5 0 0
40,000	5	,,	6½	Do. New, £4 paid	4¼—4⅜	..	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	260—265*	+3	4 10 7
270,000	,,	,,	9	Do. New . . .	187—192*	+2	4 13 9
50,000	,,	,,	5	Do. 5 p.c. Pref. .	126—130*	..	3 16 11
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	111—114	..	3 10 2
220,000	Stk.	Mar. 14	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk. .	155—160	..	4 7 6
1,047,500	Stk.	Feb. 27	5	Bristol, 5 p.c. max. .	121—123	..	4 1 4
420,000	20	Mar. 28	10	British.	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c. .	24—26*	..	4 12 4
82,850	10	,,	9	Do. 7 p.c. . . .	19—21*	..	4 5 8
500,000	10	May 31	6	Buenos Ayres (New) Ltd.	8⅞—9⅛	..	6 9 9
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	94—97	..	4 2 6
150,000	20	July 17	8½	Cagliari, Ltd. . . .	22—24	..	6 17 6
100,000	10	May 31	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
550,000	Stk.	Apl. 12	12	Commercial Old Stock	270—280	..	4 5 9
236,425	,,	,,	9	Do. New do. .	205—210	..	4 5 9
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	128—133	..	3 7 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	158—163	..	5 10 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	160—165	..	4 4 10
575,000	Stk.	Feb. 28	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
486,090	10	July 17	10½	European, Ltd. . . .	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4⅛	Gas-light and Coke 4 p.c. Ord. . .	90—92*	−1	4 15 8
2,600,000	,,	,,	3½	Gas-light and Coke 3½ p.c. max. .	88—90*	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke 4 p.c. Con. Pref.	110—113*	..	3 10 10
4,063,425	,,	June 14	3	Gas-light and Coke 3 p.c. Con. Deb.	91—93	..	3 4 6
70,000	10	May 31	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	May 15	10	Imperial Continental .	208—211	+1	4 14 9
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	99—101*	..	3 9 4
561,000	Stk.	Feb. 28	10	Liverpool United A	236—238	..	4 4 0
718,100	,,	,,	7	Do. do. B	172—176	..	3 19 7
306,083	,,	June 28	4	Do. do. Deb. Stk.	118—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd. .	4⅛—5	..	4 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	106—109	..	4 11 9
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	103—105	..	4 5 9
541,920	20	May 31	3½	Monte Video, Ltd. . .	9—10	..	7 0 0
717,946	Stk.	Aug. 9	8½	Newc'tle & G'tesh'd Con.	225—227	−½	3 14 11
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd. . . .	7⅞—8	+¼	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6¾—7	+¼	5 2 11
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅜—1⅝	..	4 11 5

*Ex. div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 28	7	Ottoman, Ltd. . . .	5⅝—6¼	..	5 12 0
851,070	10	Apl. 26	7	River Plate Ord. . .	10⅜—11¼	..	6 4 5
250,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
250,000	10	Mar. 28	8	San Paulo, Ltd. . . .	10⅜—11⅛	..	6 19 1
135,000	Stk.	Mar. 14	10	Sheffield A	240—245	..	4 1 8
209,984	,,	,,	10	Do. B	238—243	..	4 2 4
523,498	,,	,,	10	Do. C	237—242	..	4 2 8
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	123—126*	..	3 19 4
1,627,965	,,	July 17	3	Do. 3 p.c. Deb. . .	91—94	..	3 3 10
380,940	Stk.	May 15	5	Southampton Ord. . .	106—111	..	4 10 1
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Feb. 28	6	Tottenham and Edmonton A. 5 p.c.	115—120	..	5 0 0
250,520	,,	,,	4½	Tottenham and Edmonton B. 3½ p.c.	85—90	..	5 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c. . .	9—10*	..	4 10 0
172,000	10	,,	6	Do. 7 p.c. . .	11—12*	..	5 0 0
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	103—108	..	3 14 1
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord. . .	285—290	..	3 15 10
150,000	,,	,,	5	Do. 5 p.c. Pref. .	150—155	..	3 4 6
160,000	,,	,,	4¼	Do. 4¼ p.c. Pref. '75	137—140	..	3 4 4
175,785	,,	Mar. 28	4¼	Do. 4¼ p.c. Deb. .	140—145	..	3 2 1
1,720,560	Stk.	Apl. 12	7½	East London, Ord.. .	187—192	..	3 12 11
654,740	,,	June 14	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
980,169	,,	,,	3	Do. 3 p.c. Deb. .	94—96	..	3 2 6
700,000	50	June 14	8	Grand Junction 10 p.c. max..	102—105	..	3 16 2
310,000	Stk.	Mar. 28	4	Grand Junction 4 p.c. Deb..	123—127	..	3 3 0
708,000	Stk.	Aug. 15	14	Kent	275—285*	..	4 18 3
160,000	,,	,,	7	Do. New, 7 p.c. max..	198—203*	..	3 9 0
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max..	265—270	..	3 17 9
406,200	100	,,	8	Do. 7½ p.c. max..	204—209	..	3 16 7
350,000	Stk.	Mar. 28	4	Do. 4 p.c. Deb..	123—126	..	3 3 6
500,000	100	Aug. 15	12⅛	New River, New Shares	390—395*	..	3 4 6
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
902,300	Stk.	June 14	6	South-wark and Ord. . . .	172—177	..	3 7 9
126,500	100	,,	6	South-wark and 7½ p.c. max.	162—167	..	3 11 10
489,200	Stk.	,,	5	South-wark and 5 p.c. Pref. .	147—152	..	3 5 9
1,019,585	,,	Apl. 12	4	Vauxhall 4 p.c. A Deb.	123—128	..	3 2 6
1,155,066	Stk.	June 14	10	West Middlesex. . .	264—269	..	3 14 5
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	138—143	..	3 2 11
200,000	,,	Mar. 14	3	Do. 3 p.c. Deb. .	95—98	..	3 1 3

*Ex. div.

left. Mr. Birkett protested against the purchase of additional cookers on the strength of a test extending over 22 days only. He said he had heard disparaging remarks made by practical men about these cookers; and he moved, as an amendment, that the question be referred back to the Committee. Mr. Plews seconded the amendment, and characterized the proposal as a wrong thing. The Council should not, he said, purchase any more cookers until those they had had been given a fair trial—say till Christmas. After some discussion, in the course of which Mr. Birkett put some questions, of which he had given notice, as to the business relations of Mr. Abbott with the makers of the stoves, the latter replied. He said that when they first adopted the slot meters and cookers, he believed all the members of the Council had reasonably considered in their own minds whether or not it would be an advantage. It was not a question of whether they should have 50 or 5000 of them. If they adopted the system for the sake of making a profit for the benefit of the ratepayers, he did not see why they should stop at 50. The slot meters and cookers were nothing new; the system had been in use in other towns for years, and had proved a big success. They wanted to make the gas undertaking pay; and this was the reason for the recommendation. As to his business relations with the makers of the stoves, if Mr. Birkett would make a direct charge that he (Mr. Abbott) was getting a commission, he would deal with the matter elsewhere. In the meantime, he refused to answer the questions. On the amendment being put, it was lost by five votes to seven. The purchase of the meters was therefore confirmed.

MUNICIPAL GAS SUPPLY AT GHENT.

It is now three-quarters of a century since the historic city of Ghent, the capital of the province of East Flanders, first received a supply of gas. The works doubtless were adequate for their purpose at the time; but in the course of events the business passed into the hands of a Company whose headquarters were in Paris. It had been formed with a capital of 3,000,000 frs. (£120,000), in 500 shares, bearing 5 per cent. interest; in addition, borrowing powers were possessed to make the entire capital, share and loan, adequate to meet the initial and the working expenses. Things appear to have gone on very satisfactorily until the advent of electricity, when the Municipality put up some electric lamps in their establishments, and manifested a desire to have them used for lighting the public thoroughfares. They were, however, opposed by the Gas Company, and the matter was taken into Court, where the Municipality were unsuccessful. This was towards the close of 1899. The next step was the sending of a communication by the Sheriffs' Council to the Directors, asking them if the Company would be disposed to cancel their concession at a price. The reply was in the affirmative; whereupon negotiations for the transfer of the undertaking were instituted and quickly brought to a satisfactory conclusion. On the 10th of September last year, the shareholders ratified the agreement entered into by the Directors with the Municipal authorities, and authorized the winding up of the concern. The purchase price was fixed on the 1st of October at 6,051,000 frs. (£242,040), of which a sum of 1,400,000 frs. (£56,000) was for the works and plant, with the adjacent workmen's dwellings. The Company had a bank balance of 475,000 frs. (£19,000), of which the Municipality took possession, as well as of 122,285 frs. in hand. They entered into possession of the works as from the 1st of October, and the shareholders and creditors of the Company were paid off with the money placed at their disposal by the transaction. The Company some time ago reduced to 10 c. per cubic metre the price of gas used for cooking, heating, and motive power; and, for the present, no change has been made. The quantity of gas sent out in the year 1899-1900 was about 390 million cubic feet; the number of burners in use was 125,467; of meters, 7759; and of public lamps, 3659. In framing the budget for the current year, the expenses were estimated at 1,970,000 frs. (£78,800), and the receipts at 2,120,000 frs. (£84,800); so that it was expected that there would be a net profit of 150,000 frs. (£6000) to be added to the general revenue of the city. Though the Municipality have acquired the gas undertaking, they have not yet definitely decided whether or not they will continue to carry it on themselves. The provision of an electric light installation is in contemplation, and the completion of the preliminaries is being awaited, so as to see if the two services can be worked together, either by the Municipality or their lessees, or whether it will be better to sell them. Pending a decision on this matter, things have been left much as they were under the Company, except that the workmen have been temporarily placed upon the civic pension list. The management of the works remains in the hands of the Company's officials, who are now under the control of a Municipal Engineer, acting under the Council and a Special Committee.

ELECTRIC LIGHTING NOTES.

At the recent meeting of the Queenstown Gas Company, one of the Directors (Mr. J. O'Meara) stated that, according to the estimate prepared by the Town Clerk for the coming year, the cost of lighting the town by electricity would be £150 per annum more than when gas was employed.

Considerable excitement was caused in the Temple last Tuesday afternoon by a loud explosion in one of the electric light boxes, situate outside Lamb Building. The flames rose to a considerable height, and the force of the explosion lifted out of its place the heavy stone slab covering the box. This being the Long Vacation, and consequently a quiet time in the Temple, no one was near the box when the mishap occurred. The damage was repaired later on.

At the meeting of the Police Department of the Glasgow Town Council on Monday last week, Mr. D. M. Stevenson asked the Convener of the Watching and Lighting Committee why in Sauchiehall Street, west of Charing Cross, the gas-lamps were kept burning alongside the electric lamps. Mr. Primrose replied that it was in case of anything going wrong with the electric light. (Laughter.) There was

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some laughter; but, as a matter of fact, they had had repeated breakdowns, and they wanted to provide against the possibility of a densely crowded thoroughfare being put into total darkness. Mr. Stevenson asked why, in that case, the lamps were kept burning west of Charing Cross only. Mr. Primrose replied that it was deemed necessary to preserve the extra safeguard only in the immediate neighbourhood of the Exhibition.

A special meeting of the Barnstaple Town Council, which was called for Saturday week to consider the question of the adoption of the electric light, had an unexpected development. Mr. C. E. R. Chanter proposed to move a resolution to the effect that it was undesirable to proceed with the application for power to borrow £27,000 for the scheme until it had been not only favourably reported upon by an expert, but formally approved by the ratepayers. At the outset, however, it was ruled by the Mayor that shareholders in the Gas Company could neither speak nor vote on the question of the electric light. Seven members of the Council, including Mr. Chanter, were found to be disqualified by this circumstance from participating in the proceedings; and several of them left the meeting. Mr. J. G. Hamling moved the adoption of a report of the Electric Lighting Committee, who had decided not to accept the offer of a London firm to erect works and supply the Corporation with electricity in bulk, but to proceed with the application for borrowing powers for the construction of works themselves. Mr. Hamling said he was perfectly sure that if the project was carried out it would result in financial profit to the borough. Mr. Young objected to the scheme which had been accepted by the Committee, and contended that more information was necessary. They had had two reports diametrically opposed to each other, and an eminent electrician whom he knew was opposed to the scheme. The motion was carried by ten votes to three—the members owning shares in the Gas Company taking no part in the division.

During the year ending March 25 last, the consumers of electricity in Leeds increased from 1393 to 1829, equivalent to 31·3 per cent.; and the lamps and other devices installed, from 106,263 to 132,283, equivalent to 24·5 per cent. In their report, which will be shortly presented to the City Council, the Lighting Committee say: The use of electricity as a motive power, though still very limited, is extending; the number of motors connected to the mains at March 25 last being 86, with an aggregate of 205-horse power, an increase of more than 100 per cent. during the twelve months. The number of units sold were 2,520,414, compared with 2,005,840 in the previous year—an increase of 514,574 units (25·6 per cent.). The average price obtained was 4·03d. per unit, compared with 4·09d. per unit in the preceding year; and the average consumption per 35 Watt lamp was 20·8 units, yielding a revenue of 6s. 11·8d. The capacity of the plant installed at the works has been increased from 3040 to 4020 kilowatts (6700 indicated horse power), and contracts have been entered into for additional plant with an aggregate output of 4720 kilowatts, making a total of 8740 kilowatts. Contracts have also been entered into for the erection of buildings in extension of the works on the site formerly occupied by the Britannia Mills. The abnormally high price of coal, the Committee point out, has largely increased the cost of production, which was 1·31d. per unit, as compared with 1·19d. in 1900. The capital expenditure during the year was £60,575. The total receipts on revenue account were £43,669; and the working expenses were £13,770, leaving a gross profit of £29,899. After deducting interest and sinking fund, a surplus remained of £6881. Of this, £6000 became available for the relief of rates.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Greenock Police Board on Tuesday had a long discussion upon the accounts of the gas undertaking for the past year. In introducing the subject, Bailie Campbell said he disclaimed anything in the nature of responsibility for the results of the statement. They took charge in the middle of the year, while the inaugural business had been arranged and so far carried on. They had to follow in the footsteps of their predecessors, and pursue the policy inaugurated by them. The point most likely to attract attention was the deficit of £2311. This result was not at all unexpected, and the cause was not difficult to seek. It lay on the surface, and was because the estimates last year were based upon far too low figures. He was entirely at a loss to know how the estimates had been arrived at. It might be worth while mentioning that the works were not carried on in an extravagant manner last year. The working expenses, exclusive of coal, in 1900 were £20,269, against a working expenditure during the previous year of £20,314, leaving a fractional sum to the benefit of last year. He referred to the coal estimate for last year, which, he said, had been entirely conjectural. There was to have been a saving of £1300 on wages; but, unfortunately, this did not result, though wages cost £300 less than in 1900. In the estimates for this year, they anticipated a large increase from residual products, and an increase of £313 from town and harbour lamps. The deficit of £2311 1s. 10d. ought to show them the importance of the Gas Trust being provided with a contingent fund, so that in a year like the past a sum might be taken out from the earnings of the previous year. He did not propose to make provision to liquidate this deficit. It was not done last year; and he was not going to do it this year. He would leave it in suspense till a more favourable time. Another reason was because he apprehended very much that, if there was an increase in the price of gas, there would be a material frightening away of their customers. Mr. Morison seconded. After remarks by several members, Mr. Mitchell moved that a Committee be appointed to consider the statements made, and report to a future meeting. Bailie Campbell replied, repeating his motion for the adoption of the minutes, which would continue the gas-rate as last year—viz., 3s. 4d. per 1000 cubic feet. On a division, the minutes were passed.

The Arbroath Gas Corporation last week had a statement of the accounts before them. Mr. Robertson, the Convener of the Finance Sub-Committee, moved their approval. He said it would be noticed that the balance of receipts over expenditure amounted to £4983. In

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SULPHATE OF AMMONIA PLANTS.

other words, the Corporation had received on account of capital £4983 more than they had expended. This required explanation, and was accounted for as follows: There were stocks of coal on hand amounting to £2918, and outstanding accounts amounting to £2964. Then, the sum at the debit of the old contingent account was £2581, from which had to be deducted the sum at the credit of the new contingent account, £656, making a total expenditure of £7807. If they deducted from this sum the amount due to the bank, £2844, there remained a balance of £4963, which represented as nearly as might be the balance on the capital account. The only other item in the abstract requiring notice was the balance of expenditure over revenue, which amounted to £496. Owing to the accounts having been closed at May 15 instead of July 15, it was impossible to make a correct comparison between the working of the present year and the estimate upon which the price of gas for the year was fixed; but an approximation might be made. The deficiency, as already stated, was £494, from which had to be deducted the deficiency of the previous year, amounting to £250, leaving a deficiency applicable to the present year of £246. It would be observed that the accounts only showed ten months of revenue, while the expenditure included the full year's annuities and interest, amounting to £1843. If, therefore, a sixth part of this sum were taken to represent the period from May 15 to July 15—£307—instead of a deficiency there would be a surplus of revenue over expenditure of £61. But that was not a reliable calculation, because during the two months referred to the quantity of gas consumed was very small, and the revenue for these months would not nearly average one-sixth of the whole year. He therefore thought that the deficiency could not be estimated at less than from £150 to £200. The accounts were approved, and were ordered to be printed.

I do not know that anything could better illustrate the general incapacity of the Corporation of Dundee for the performance of municipal work than what has taken place in connection with their conduct of the gas undertaking. They have been engaged for a year or two in the general improvement of the works, with a view to a reduction of the expenses. This has now been accomplished; and the result has been attained. Having attained it, some of the members of the Corporation are horrified at their success. About twenty men, whose services in the works ranged from four to forty-two years, have been discharged. No doubt it is a sorry thing to see a man who has filled a situation for forty years turned adrift; but the Corporation must surely have known that this would be the result of the introduction of mechanical stoking. If they were not aware that this would be the case, incapacity at once crops out; if they were aware of it, they have done nothing as yet to ameliorate the condition of those who were doomed to be dispensed with, and there again there was not only incapacity, but a state of matters which robs the horrified ones of all right to be regarded as the friends of the distressed workmen. He is surely a poor protector who sees the stroke coming, and does nothing to mitigate its force. I take it that but for the love, favour, and affection which certain members of the Corporation have for the votes of the working classes, this subject might not have been heard of at the present time; but if this be a correct reading of the situation, the mode of raising it is about the most blundering one which could have been adopted. It was discussed at a meeting of the Gas Committee on Tuesday last; and Mr. Ballingal, the Convener, pointed out that it was inevitable that some men should be dismissed, as they were no longer required. He stated, however, that he would put himself into communication with the heads of other public departments, and endeavour to get work for these men. This is, at least, poor comfort, as we can all judge how far the effort to secure employment for the unfortunate ones will go. But it is further notable that the promise of succour, so far as it goes, does not come from the friends of workmen, but from those who have compassed their undoing. The working man's friend is here, as too often elsewhere, one who can perceive a wrong, but is helpless to right it. The situation which has arisen is such that it was inevitable that the working man agitator should come in. As soon as the state of affairs became known, the Trades Council took the matter up, and meetings have been held, at which the manifest balderdash was told to the men that it was the want of organization among them which had made the dismissals possible. It is, of course, the grossest absurdity to say that any organization whatever would have led the Gas Committee to keep more men in their employment than they have need for. But the argument is quite good enough for the purpose; and at a meeting at which the fraternal Blackwood was present, an organization was formed, which it is reported about a hundred of the men joined. It is not said what the men who have been dismissed will gain by a branch of the Union being formed; and as there are to be no more dismissals—there being work for all who have been retained—the good which the Union will do to those who have not been dispensed with is also non-apparent.

The accounts for the past year of the Forfar Gas Corporation were before the Town Council on Wednesday. They showed a deficiency of £1002. Bailie Hanich, the Convener of the Gas Committee, in presenting the accounts, said that they hoped this year to save £600 upon their coal contracts, and that, with careful management, the deficit at the end of the year would be reduced to a very small sum. He moved that the price of gas be raised from 3s. 9d. to 4s. 2d. per 1000 cubic feet. There was a discussion as to whether the price should not be raised to 4s. 6d.; but the proposal of Mr. Hanich was adopted by an overwhelming majority.

An unfortunate accident has happened to a part of the new works for bringing in the water from the Talla district to Edinburgh. A partly finished tunnel near Penicuik was this week discovered to have been rent in several places. It has been resolved to ask Mr. Hill, the Consulting Engineer to the Water Trust, to inspect it and report. In the meantime, the Works Committee of the Trust, with the local Engineers and Contractors, visited the spot on Wednesday. A report which may be regarded as official has been issued. This states that discussion took place as to the cause of the defects. It was thought by some that these were due to the sole or invert at the bottom of the tunnel having been so long in being put in. This portion of the tunnel was practically finished about two years ago; and the Contractor was anxious

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to have the invert put in, and made application to one of the officials for permission. The defects consist of a number of diagonal cracks, running from near the bottom of the tunnel to near the arch. They are not very wide, and are confined entirely to the side of the tunnel next the Pentland Hills. In some parts the bottom of the tunnel at one side is bulged out 4 or 5 inches. Little or no damage is apparent on the other side of the tunnel. The tunnel, which is one of seven in the district, is about 6 feet high by 6 feet wide; and the wall is constructed of concrete 15 inches thick. All the damage is comprised within a distance of about 400 feet. The Sub-Committee, after hearing the Contractors and officials, decided in the first instance to ask Mr. Hill to inspect and report on the whole of the tunnel works constructed, or being constructed. No estimate has yet been given as to the probable cost of repairing the damage. Meanwhile, the tunnel has been made secure, by means of shores, against further collapse.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 24.

Sulphate of Ammonia.—There has been a quiet market throughout the week; and on the East Coast prices have barely been maintained. The closing quotations are £10 7s. 6d. per ton f.o.b. Hull, £10 10s. f.o.b. Leith, and £10 12s. 6d. to £10 13s. 9d. f.o.b. Liverpool. There has, however, been fair inquiry; but buyers have been very deliberate, and it remains to be seen whether they will be able to hold out beyond the end of the month. The forward position has been neglected; makers being firm, while buyers have not been willing to pay any substantial premium on spot prices.

Nitrate of Soda is firm in all positions; and spot prices remain 8s. 9d. to 9s. per cwt., for ordinary and refined qualities respectively.

LONDON, *Aug.* 24.

Tar Products.—Business generally is quiet, and there is nothing of special interest to advise. The demand for pitch continues very good in South Wales, where consumers are very short of stock, and are pressing for prompt delivery. As regards London and the East Coast, there is not much demand for prompt delivery. Doubtless, however, this is owing to the difficulties of shipment during the hot weather. In benzol, a sale of 90 per cent. is reported at 9d. at an outport, prompt shipment; but manufacturers still decline to sell forward at under 10d., and in some instances ask 10¾d. There is a good deal of inquiry for next year; but no transactions have taken place. The 50-90 per cent. continues very dull. There is no demand for this quality at present. There is nothing fresh to report in anthracene; no transactions having taken place. Crude carbolic is certainly easier, business having been done in 60's at 1s. 11d. prompt. Consumers are now only open to purchase for August-October, and decline to consider business over the first six months of next year. Crystals are also easier, one of the English makers having reduced the price from 8d. to 7¾d. per pound. Creosote is decidedly easier. There are, evidently, heavy stocks in certain quarters; and these must be cleared out before the winter. The London makers are fairly well sold; so that prices here are maintained out of proportion to those ruling in the Provinces. A little business has been done in solvent for export, but at very low prices; 11d. and 11⅛d. having been accepted for 90-100. As regards tar, there is nothing important to advise; but the prices quoted in the Provinces are still very much higher than is warranted by the values of products.

The average values obtaining during the week are: Tar, 14s. 6d. to 18s. Pitch, east coast, 30s. 6d. to 31s.; west coast, 28s. to 28s. 6d. Benzol, 90's, 9¼d. to 9½d.; 50's, 9d. Toluol, 10d. Crude naphtha, 4¼d. Solvent naphtha, 11d. to 1s. Heavy naphtha, 10d. to 11d. Creosote, 1d. to 1¼d. Heavy oils, 2d. Carbolic acid, 60's, 1s. 11d. Naphthalene, 60s. to 70s.; salts, 30s. to 40s. Anthracene, "A," 2¼d. to 2⅜d.; "B," unsaleable.

Sulphate of Ammonia.—The market is decidedly quiet, and prices are easier all round. The Gaslight and Coke Company still quote £10 15s. for Beckton make; but at this price there are no buyers. The Hull market is very quiet, and £10 7s. 6d. may be taken as the actual value of ordinary makes. As regards Leith, buyers will not pay more than £10 8s. 9d.—in fact, only small parcels can be placed at this price, the actual market value being not over £10 7s. 6d. prompt shipment. The demand for Liverpool continues fairly good. Small sales are reported at £10 12s. 6d. prompt. The general tone of the market is certainly easier for prompt delivery, although there is rather more disposition to buy for forward delivery, if reasonable prices were quoted by makers.

COAL TRADE REPORTS.

Lancashire Coal Trade.—Business in this district continues to drag on slowly, and the position generally remains without material change. The better qualities of round coal are only in the smallest possible request for house-fire purposes; and four days is the maximum time pits are working, with collieries here and there not putting in more than two or three days per week. Even with this restricted output, stocks are accumulating in considerably larger quantity than for some years past. The basis pit prices, however, are being held to, although in the open market special quotations are frequently made to effect clearances of stocks accumulating under load at the pit-sidings. List rates are still quoted at 15s. per ton for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four feet and seconds Arley, and 11s. to 11s. 6d. for common house coals, at the pit. Common round coals are in moderate request for iron-making, steam, and general manufacturing purposes; but supplies are in excess of requirements, and low figures are here and there taken to effect sales for prompt delivery. On ordinary trade or forward contracts, however, the general basis of prices remains at about 9s. per ton at the pit. There is nothing new to report with regard to gas coals, as practically all the contracts

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have now been settled at about the rates that have previously been given; but collieries are expecting shortly to be called upon for larger deliveries, which will tend to strengthen their position with respect to other descriptions of common round coal. Engine fuel is steady at about late prices, the very limited demand for round coal restricting the production of slack; and the better qualities, although ample for requirements, are not over-plentiful on the market, with Lancashire coalowners holding to about 8s. for the best descriptions, and from 6s. and 6s. 6d. upwards for inferior sorts of engine fuel at the pit mouth. Slack in other districts, however, is accumulating heavily, and is being pushed on outside markets; while there is every probability as the winter season approaches, and more round coal is required, that the local output of slack will begin to hang, and in some quarters lower prices for engine fuel are being anticipated. There is, however, the fact that the coke trade is decidedly improving; and with better prices got, more ovens are being put in, which will help to take off a large quantity of slack that might otherwise be offered as surplus on the market. For shipment there is rather more inquiry; but no appreciably better prices are obtainable. Common steam coal could still be bought under 10s. per ton, with good qualities about 10s. 3d. to 10s. 6d., delivered at Mersey ports. For house coal, in which a fair business is being done for shipment to Ireland and various English ports, prices range from 11s. and 11s. 6d. upwards, delivered at the Mersey ports. Coke prices at the ovens are steady at about 24s. to 25s. per ton for good Lancashire foundry sorts, 13s. to 14s. for good washed Lancashire furnace cokes, 12s. 6d. to 13s. for Yorkshire washed furnace cokes, and 11s. 6d. to 12s. for unwashed furnace sorts.

Northern Coal Trade.—There is undiminished activity in the coal trade of the North; indeed, the pressure for certain kinds of coal has increased, and has forced up the prices. In the steam coal trade, best Northumbrian kinds are steady at about 13s. 6d. per ton f.o.b., and the demand is full for a month ahead or so; but beyond that time, sales are effected only at a slightly lower price. Steam smalls are from 5s. 3d. to 5s. 6d. f.o.b., with an average demand. Manufacturing coals are rather quieter, and there is a moderate amount of demand only. The gas coal trade seems to have shown the greatest activity of late, heavy shipments being called for on the long contracts, so as to get away as much as possible clear of the duty. This has stiffened the prices, and up to 11s. 9d. per ton f.o.b. has been asked for best Durham gas coals, for early delivery. The effect of the full demand, and of the large amount of the output which is already contracted for, has been to force up even the prices of forward deliveries, so that for contracts with delivery into next year, from 9s. 6d. to 10s. per ton f.o.b. is asked for the produce of the best collieries. In the coke trade, there is a steady demand. Best export coke is quoted at from 17s. 6d. to 18s. 6d. per ton f.o.b. Gas coke is a little firmer, at 12s. per ton f.o.b. for good sorts.

Scotch Coal Trade.—There is little change in the market. The miners have refused to accept the masters' proposed reduction of 12½ per cent., equal to 6d. per day upon wages; and at meetings of the Conciliation Board in Glasgow last week, it was agreed to adopt a proposal by the miners that a neutral chairman should be appointed to fix the wages, whose decision should be binding upon both parties. This has the semblance of continued amity. In the meantime, stocks are not accumulating, the demand being equal to the production; and the market is altogether of a sporting nature. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. to 10s. 6d., and splint 10s. The shipments for the week amounted to 235,276 tons—an increase upon the previous week of 12,519 tons, but a decrease upon the corresponding week of last year of 7365 tons. For the year to date, the total shipments have been 6,026,612 tons—a decrease upon the same period of last year of 662,921 tons.

Fatal Gas Explosion near Cleveland (Ohio).—According to a Central News telegram sent from New York last Wednesday, five men were suffocated on that day by an explosion of gas near Cleveland (Ohio). They were engaged in making a tunnel in connection with some new water-works on the Lake Erie shore.

Bursting of a Water-Main at Hampstead.—Last Friday night, in Finchley Road, Hampstead, a main belonging to the West Middlesex Water Company, situated immediately over the main line tunnel of the Midland Railway, burst. The main, which is one of three supplying a large district, is 15 inches in diameter, and is about 2 feet below the surface of the roadway. The pressure of the released water caused the upheaval of the wood pavement to the height of 18 inches across the roadway; and the heavy granite kerbstones of the footways were broken. The wood-paving blocks were displaced for a distance of more than 300 yards; and the water spread across the road and paths. The flow continued for half-an-hour, and a large volume penetrated to the tunnel below, through which run the goods lines of the Midland Railway. The flow of water was stopped by cutting off the supply at the pumping-station at Barrow Hill Road.

Legality of Differential Water-Rates.—Early in the year, the Northampton Corporation had under consideration the question of the method of levying the water-rate; and it was ultimately decided to reduce the rate in the old borough from 7½ to 5 per cent. on the rateable value, but to maintain the existing charge of 7½ per cent. in the districts lately added. Strong objection was taken to this differential rating, and doubts were expressed as to its legality. We learn that some of the aggrieved ratepayers have, through their Solicitors, laid a case before Mr. Balfour Browne, K.C., for his opinion. The question submitted to him was: "Can the Corporation lawfully charge the differential water-rate proposed?" The following is his reply: "I find nothing in the Acts in the nature of an equality clause, but I find, on the other hand, nothing which allows the Corporation to vary their rates; and I am of opinion that the Corporation are bound to charge the same rates to all persons under similar circumstances. Therefore the answer to the question is that the Corporation cannot lawfully charge the differential water-rates proposed." There is every probability that, in the face of the above opinion, many of the ratepayers in the new districts will decline to pay their Michaelmas water-rate.

A "NEEDFUL" EXPLANATION.

INCLINED RETORTS.

An Advertisement has been running in these Columns for a considerable period warning the Trade generally against Infringing the Patent Rights of the **NEW CONVEYOR COMPANY OF BIRMINGHAM.**

An action was instituted by that Firm against **THE BRIGHOUSE CORPORATION** in the High Court of Justice asking for an injunction restraining them from Infringing their alleged Patent Rights.

After entailing considerable expense upon themselves and upon the Corporation, the **NEW CONVEYOR COMPANY** had to abandon the Action, and have **NOW TO PAY ALL COSTS AND EXPENSES** connected with the same.

JONAS DRAKE & SON, OVENDEN, HALIFAX.

GRAHAM, MORTON, & CO., LIMITED, LEEDS.

W. J. JENKINS & CO., LIMITED, RETFORD.

WINSTANLEY COMPANY, COVENTRY.

Scheme for Ending Strikes.—We learn from a Manchester paper that a large scheme is being promoted in the North of England with a view at one and the same time to increase the efficiency of British manufactures so as better to meet foreign competition, and to unite in a National Industrial Association of employers and employed, and so to facilitate common action and agreement that strikes and lock-outs, if not entirely abolished, shall be minimized. The scheme proposes: (1) To bring about an association of those engaged in trade; (2) to keep before the minds of the employers and employed the fact that the practical recognition of their common interest will strengthen and promote British trade and commerce; (3) to inquire into, and report upon, matters affecting British trade and commerce, with a view to enabling our manufacturers to hold their own in the markets of the world; (4) to create and cement, between employers and employed, a feeling of common interest. The fundamental idea is that, if masters and men can be educated to the fact that their interests are identical, strikes and lock-outs will be things of the past; and it is urged that the way to do so is to find some common ground on which they can informally meet and discuss matters of mutual interest. The scheme is due to the initiative of Mr. John Lockie, of Newcastle-on-Tyne, who, it is reported, has undertaken to meet the necessary expenses of its inauguration.

Abertillery District Council and their Water-Works.—At the last monthly meeting of the Abertillery District Council, some discussion arose upon the decision of the Local Government Board, presented at a previous special meeting (*ante*, p. 410) that sanction to borrow an additional £4500 for the purpose of remedying defects in the reservoir and service-tank at Cwmtillery could not be granted under the present Act of 1894, as it appeared that the defects were "mainly due to the absence of proper care and supervision in the design and construction of the works." The Board also considered that the proper course for the Council to adopt was to employ an engineer of eminence in water undertakings to report upon the stability of the reservoir and the new proposals. Mr. Togarmah Rees, the Engineer, at that meeting fully explained his position. These facts, which appeared on the minutes, became known to the public, and several members expressed the desire to emphasize the fact that it was resolved at the special meeting—"That the Council exonerate Mr. Togarmah Rees from all blame with regard to the supervision in the design and construction of the water-works." It was further pointed out, as stated at the inquiry, that the non-success of the undertaking was due to circumstances over which the Engineer had no control. It was resolved to employ an engineer, as recommended by the Local Government Board, and the Clerk was instructed to write an explanatory letter to the Board, pointing out that there was no necessity to call in another engineer, and that the Board had full power to sanction the loan under section 43 of the Abertillery Local Board (Gas and Water) Act, 1894. The Clerk (Mr. J. A. Shepard) at the monthly meeting read the reply of the Board, which was to the effect that no useful purpose would be served by a discussion as to how their decision was arrived at with regard to the sanctioning of the loan sought for.

Artesian Wells for India.—An article in the "Pioneer Mail" for the 5th ult. deals with the important question of artesian wells for India, and it is urged that the Imperial Government should undertake a series of borings. Mr. Griesbach, the Director of the Geological Survey of India, has suggested a locality where search for artesian water might be made. If successful, the wells would, he says, be useful in the northern division of Bombay.

Driffield Gas Undertaking.—At a recent meeting of the Driffield Urban District Council, a satisfactory statement of the year's working of the gas undertaking was made by Mr. J. F. Shepherdson, Chairman of the Gas Committee. Having mentioned that the Local Government Board had just sanctioned a loan of £5500 for improvements to be effected on the works, including the erection of a new gasholder, he said the working statement for the twelve months ending June 30 showed, on a consumption of 83 tons less coal, an increase of 890,000 cubic feet of gas. This result made very pleasant reading, especially as the Committee had had to deal with a very considerable leakage, partly from defective mains and services. The leakage was 427,000 cubic feet, or 2·05 per cent., less than in the year ending June, 1900. The illuminating power of the gas manufactured had also been raised from 16·88 candles to 17·54 candles; and the coke sold per ton of coal carbonized showed an increase of 0·2 per cent. The Committee were convinced of the absolute necessity of the proposed new holder. At a subsequent meeting, it was resolved—"That the tender of Messrs. C. & W. Walker, Limited, for supplying and erecting the new gasholder and steel tank, governor, and connecting mains, for £3380 be accepted, and a contract prepared; and that Mr. Tobey prepare the plans and specifications for works required for the foundations for the gasholder tank, governor-house, and boundary walls."

Day Consumption in Excess of Night Consumption in New Orleans.—Our readers are aware that a great change has lately been made in the method of conducting the business of the New Orleans Lighting Company; and the result has just been recorded in the "American Gaslight Journal." We learn from that source that the Manager (Mr. Bankson Taylor) lately made the following statement: "For the first time in the history of the manufacture of gas in New Orleans, the gas consumed during the day equals or exceeds that burned at night. This condition was brought about by the introduction of gas-stoves in very large numbers in the city during the last two months. It is a condition very much desired by the Company, and also is one that may prove of material benefit to them in the course of time. The heavy expense attached to the manufacture of gas in the past has been partly due to the fact that the losses suffered by the Company through the non-consumption of gas in the day dissipated the profits derived from the gas burned at night. This condition is rapidly changing, as is evidenced by the increased consumption of gas during the day since the middle of May, when gas-stoves became in wonderful demand there. With this notable shifting in existing conditions, the consumer stands a splendid chance of being able to secure the popular product for lighting and heating on much more advantageous terms than is even afforded now."

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

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WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
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SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA.	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE.	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN.	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

ORDERS RECEIVED IN 1901 TO MARCH 1 . . . . 3,500,000 CUB. FT. DAILY.

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Brynmawr Water Supply.—Last Wednesday Mr. W. O. E. Meade-King, M.Inst.C.E., held an inquiry at Brynmawr relative to the application of the Urban District Council to the Local Government Board for sanction to borrow £8000 for enlargement of the reservoir, extension of the filter-beds, relaying of the mains throughout the entire system, and placing water-taps in all dwellings. There was no opposition.

Leeds Water-Works Arbitration.—The award in the arbitration case of *Wright v. Leeds Corporation* has just been made by the Umpire, Colonel W. H. Wellsted, of Hull, and amounts to £14,695. The claim, the hearing of which occupied some days at Leeds, was for the taking of certain farms and woods containing about 335 acres, in connection with the water-works, and forming part of the Low Snowdon Estate. Severance damages to the remainder of the estate were claimed; also an amount for relieving the Corporation of their obligation to send 5 million gallons of water per day down the River Washburn, which runs through the estate.

The Directors of Crossley Bros., Limited, have declared a dividend at the rate of 10 per cent. per annum. A year ago the distribution was at the rate of 8 per cent.

At the Lyndhurst Petty Sessions a few days ago, a consumer of the South Hants Water Company was fined 10s. and 7s. costs for using for his greenhouse water supplied for domestic purposes.

Messrs. G. Pettigrew and Co., of Middlesbrough, have received the contract to erect a complete sulphate plant, together with large cast-iron overhead liquor store-tanks, at the Calverley Gas-Works.

The tender of Messrs. J. & M. Patrick, of Walworth, has been accepted by the Newport (I.W.) Town Council for laying a 3-mile length of water-main for £2190. The tenders ranged from this figure up to £3974.

Messrs. A. & J. Stewart and Menzies, Limited, have declared an interim dividend for the half year ended June 30 at the rate of 9 per cent. per annum on the ordinary shares; being the same rate as that of a year ago.

Messrs. Graham, Morton, and Co., Limited, of Leeds, have issued an illustrated pamphlet showing their patent elevating and conveying machinery. One of the firm's elevators is now working in the boiler-house at the Glasgow Exhibition.

Owing to the continued dry weather, the water in the Widdop reservoir of the Halifax Corporation was found, on the occasion of the recent visit of the Water Committee, to be no less than 23 feet down—a point it had not reached for years.

Out of 66 cases of profit-sharing respecting which full returns have been obtained by the Board of Trade, an average bonus of 6·4 per cent. on wages paid in 1900 was distributed. In the majority of cases, the bonus varied between 5 and 7 per cent.

At the Brentford Police Court last Wednesday, John Coleshill, 15, was committed for trial on a charge of entering No. 41, Oaklands Road, Hanwell, breaking the lock of the prepayment meter, and stealing therefrom 1s. 3d. the property of the Brentford Gas Company.

The Bingley District Council have ratified an agreement entered into by the Gas Committee for the supply of 10,000 tons of unscreened gas coal at 13s. per ton. The Rawmarsh District Council Gas and Water Committee have secured supplies of coal at 14s. and 11s. 6d. per ton.

The Gas Committee of the Clitheroe Corporation have lately been discussing the question of abolishing meter-rents and purchasing private meters; and the Manager (Mr. R. Barrett) laid before them the result of his inquiries in regard to other towns. The proposal has, however, been rejected.

In the small hours of Wednesday morning last, a man sought sleep in the Conway Gas-Works. He was ejected; but later on he stealthily climbed the 7-feet boundary wall, and, in the darkness, dropped into a large tank of tar. When the astonished workmen saw his grotesque figure, they were convulsed with laughter.

Messrs. Parkinson and W. & B. Cowan, Limited, have just held a very successful gas exhibition at Tipton, under the direction of Mr. Sydney O. Stephenson, Gas Engineer to the Urban District Council. It was opened by Mr. D. Hipkins, the Chairman of the Gas Committee; and cookery lectures were given twice daily by Miss Edith Sanderson.

As will be seen by an announcement which appears elsewhere, Messrs. John M. Leeder and Son have received instructions from the Directors of the Swansea Gas Company to offer for sale, on the 6th prox., at the Hôtel Métropole, Swansea, £20,000 of new ordinary 5 per cent. stock, and £6000 of 4 per cent. perpetual debenture stock, of the Company; being part of the additional capital authorized by their Act of 1898.

Messrs. R. & A. Main, Limited, have made arrangements to hold an exhibition of their gas appliances, combined with practical demonstrations on cookery, in the Burgh Hall, Montrose. It will be opened next Tuesday afternoon, and remain open up till the following Friday. They have secured the services of Miss E. M. Dods, for giving practical demonstrations twice daily in high-class and household cookery.

As an idea seems to be prevalent among the gas-lighting trade that the Voelker Incandescent Mantle, Limited, are identifying themselves with the Incandescent Trust, Limited, we are asked to state that they have no connection with that organization, nor have they any intention of associating themselves with it in any way. They assert that they are quite strong enough, and are quite prepared, to carry on their business single-handed, and to deal with any litigation which may be directed against them or their customers.

The Burton-on-Trent Town Council last Wednesday rejected a motion by Mr. Croad that legal proceedings to be taken against the South Staffordshire Water Company for the recovery of £50 expenses incurred by the Corporation in obtaining a supply of water from the river for street watering in the summer of 1899; only the mover and seconder (Mr. Thornley) voting for it. It was stated that the opinion of Mr. Cripps, K.C., was dead-against the Corporation on the matter; and the Health Committee had recommended councillors to vote against the motion.

"Just a reminder."

The "Eureka" Gas Cooker was first in 1869.

Since then it has been steadily . . perfected, Year . by Year; and it is still as far in advance as ever in

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John Wright and Eagle Range, Ltd.
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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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Resists 4500° Fahr. Best for use in GAS WORKS.
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CONTRACTS are undertaken by William EDGAR for FITTING UP HOUSES, complete with the PENNY-IN-THE-SLOT INSTALLATIONS. Gas Companies or Corporations indemnified against loss through Accidents, &c. Thousands of Houses have been fitted up by me under this System. Estimates free.
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Telegrams: "Gasoso."
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WANTED, by a Young Man (age 26), Situation as GAS-FITTER. Used to Meter and Cooker fixing and Heating Stoves. Three Years' experience in Automatic work. Good References.
Address W. J. S., 4, Trinity Road, Wood Green, LONDON, N.

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WANTED, a good Water-Works PLUMBER (Registered preferred), one who has had experience with Waste and Consumer's Meters. Must be a good Main and Service Layer.
Apply, stating Age and Wages required, to ARTHUR GRAHAM, Gas and Water Engineer, MANSFIELD.

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Applications, with Testimonials, to be lodged on or before the 7th of September next, with Mr. DREW, Doonhill, NEWTON-STEWART.

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(GAS DEPARTMENT.)
THE Gas Committee of this Corporation require an ENGINEER to take charge of the Manufacturing and Distributing Departments of their Undertaking.
The person appointed to the position will be required to devote the whole of his time to the duties; and he must be fully competent to design and carry out any alterations and extensions of Works and Plant.
Salary £450 per annum.
Applications, accompanied by *copies* of three recent Testimonials, to be sent to the Chairman of the Gas Committee, Town Hall, not later than Tuesday, the 3rd of September next.
Canvassing members of the Committee, either directly or indirectly, will be deemed to be a disqualification.
By order,
THOS. HUDSON,
Secretary.
Town Hall, West Bromwich,
Aug. 9, 1901.

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Apply, by letter only, stating Age, Qualifications, and previous Employment, to No. 3736, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, a Strong, steady, and respectable married Man, not over 30, as STOKER. Must be a good Shovel Charger, used to Engine and Exhauster, and who will make himself generally useful. Wages, 28s. per week. Only those who have had similar experience need apply.
Apply, with References, to W. C. DAWSON, Manager, Gas-Works, Arundel, SUSSEX.

MECHANICAL Engineer Wanted as MANAGER, with experience in the Gas Branch preferred.
Send application, with short Statement of Experience. *Copies* of Certificates, Salary expected, and when free, to A. B. C. 129, care of DEACON'S ADVERTISING OFFICES, Leadenhall Street, LONDON. Gentlemen without practical experience as Manager or Assistant need not apply.

WANTED, a Second-Hand fixed AMMONIA STILL for Sulphate Plant.
State Price and full Particulars, to No. 3737, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

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These Cranes are in good working order, and have been constantly in use for unloading Coals into the Company's works, but are now being displaced by larger Cranes.
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By A. WEISS, Engineer of the Works.
Translated from the German for, and Reprinted from, the "JOURNAL OF GAS LIGHTING," &c.
LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

COKE.

THE Gas Committee of the Corporation of Colne invite TENDERS for the purchase of a part, or the whole, of their surplus COKE (which is estimated at 2000 Tons) made during the Six Months September, 1901, to March, 1902.

Offers to be net at Gas-Works, or on Rail, Colne Station, and to be delivered to the undersigned not later than Tuesday, Sept. 3, 1901.

Particulars as to monthly quantities on application.

FRED. THORPE,
Engineer and Manager.

Gas-Works, Colne,
Aug. 21, 1901.

URBAN DISTRICT COUNCIL OF MORECAMBE.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the above are prepared to receive TENDERS for the supply of 5000 Tons of screened GAS COAL, to be delivered on the Gas-Works Siding, Midland Railway, Morecambe, in such quantities as may be required from the 1st of November next.

Tenders, specifying the description of Coal, the name of the Pit at which it is raised, and the Terms for net Monthly Payments, are to be sent in on or before Wednesday, the 25th of September, 1901, endorsed "Tender for Coal."

The Gas Committee do not bind themselves to accept the lowest or any Tender.

WILLIAM DUFF,
Engineer and Manager.

Market Street, Morecambe,
Aug. 19, 1901.

COUNTY BOROUGH OF BURY.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the removal of their surplus COKE—estimated quantity about 5000 Tons, to be removed between the 1st of October, 1901, and the 31st of March, 1902.

Forms of Tender and Conditions forwarded on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

The Committee do not bind themselves to accept the highest or any Tender, or consider any Tender for a quantity of less than 500 Tons, and further reserve to themselves the right to allot the quantity offered in such quantities as they may think fit.

Sealed Tenders, endorsed "Coke," to be delivered to the undersigned on or before Saturday, the 14th day of September, at 9 a.m.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bank Street,
Bury, Aug. 23, 1901.

CORPORATION OF LEICESTER.

SULPHURIC ACID.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply of SULPHURIC ACID, made from either native Sicilian Brimstone, recovered Sulphur, or Pyrites.

Specific Gravity in each case to be stated. The price to include free delivery by rail into elevated Tanks, 27 feet high, at the Chemical Works, Aylestone Road.

Probable quantity, about 1800 Tons, to be delivered as required during the ensuing Twelve Months.

Tenders, addressed to Alderman Lennard, J.P., Chairman, and endorsed "Tender for Acid," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, Sept. 7 next.

The Committee do not bind themselves to accept the lowest or any Tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.

Offices: Millstone Lane,
Leicester, Aug. 24, 1901.

URBAN DISTRICT COUNCIL OF BUXTON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Council are prepared to receive TENDERS for the MATERIALS and WORK required in the following Contracts:—

CONTRACT No. 3.—Two RETAINING WALLS and the erection of a STEEL JOIST and CONCRETE COVERING over the River.
Do. No. 4.—CONDENSERS (Capacity 40,000 cubic feet per hour).
Do. No. 5.—WASHER-SCRUBBER (Capacity 40,000 cubic feet per hour).
Do. No. 6.—STATION METER (Capacity 40,000 cubic feet per hour).
Do. No. 7.—RETORT-STACK for Five Double Settings of Eights (two only to be furnished with Retorts, &c.), on the Regenerative System, with Chimney, Cellars, &c.
Do. No. 8.—Two PURIFIERS, 40 ft. by 25 ft. by 5 ft., with Elevator, &c.
Do. No. 9.—TAR-EXTRACTOR (Capacity 40,000 cubic feet per hour).
Do. No. 10.—VALVES.
Do. No. 11.—CAST-IRON MAINS & SPECIALS.

Copies of Specifications and Bill of Quantities may be obtained from, and Plans seen at, the Office of Mr. Harold Barker, Gas Engineer, Town Hall, Buxton, on payment of Two Guineas in each case, which will be returned on receipt of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Contract No. —," to be delivered to the undersigned not later than Saturday, Sept. 21, 1901.

The Gas Committee do not bind themselves to accept the lowest or any Tender.

(Signed) JOSIAH TAYLOR,
Clerk to the Council.

Town Hall, Buxton,
Aug. 13, 1901.

COUNTY BOROUGH OF WARRINGTON.

(GAS DEPARTMENT.)

THE Gas Committee of the above are prepared to receive TENDERS for the supply of COAL and CANNEL.

Tenders to be addressed to the Chairman of the Gas Committee not later than the 30th inst.

FREDK. TAYLOR,
Secretary.

Gas Offices, Mersey Street,
Warrington, Aug. 21, 1901.

COUNTY BOROUGH OF SWANSEA, SOUTH WALES.

IMPORTANT ISSUE OF NEW ORDINARY AND PERPETUAL DEBENTURE STOCK OF AND IN THE SWANSEA GASLIGHT COMPANY.

MESSRS. JOHN M. LEEDER & SON have received Instructions from the Directors of the Swansea Gaslight Company to OFFER FOR SALE, by Public Auction, at the Hotel Metropole, Swansea, on Friday, September 6, 1901, at 2.30 for 3 o'clock p.m. precisely,

£20,000
NEW ORDINARY STOCK
(Entitled to 5 per Cent. Interest per annum), and
£6000
4 per Cent. PERPETUAL DEBENTURE STOCK
OF AND IN THE
SWANSEA GASLIGHT COMPANY.

Being part of the Additional Capital of the Company authorized to be raised by the Swansea Gas Act, 1898, and pursuant to the Provisions and Conditions therein contained.

Purchasers of the New Ordinary Stock, 1898, will be entitled to Four Months' Interest at 5 per cent. per annum as from the 1st of September, 1901, payable on the 4th of April, 1902; and Purchasers of 4 Per Cent. Perpetual Debenture Stock, 1898, to Four Months' Interest due, and payable on, the 1st of January, 1902.

Particulars, with Conditions of Sale containing all necessary Information, may be obtained on application to THORNTON ANDREWS, Esq., Secretary and Manager of the Swansea Gaslight Company, Oystermouth Road, SWANSEA, or to the AUCTIONEERS, 46, Waterloo Street, SWANSEA.

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MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

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OF LONGWOOD.

It is the fruit of 33 years of practical and professional experience. It is very painstaking and complete. A large portion of the matter is adaptable to the book-keeping of Local Authorities. A thoroughly practical and excellent work.—*Glasgow Herald.*

Unlike most of the recent works on book-keeping, this volume is a valuable addition to the literature of the subject. Of text-books on book-keeping in general we have more than sufficient; but we heartily welcome the appearance of such books as this which deal exhaustively with the accounts of some particular industry. The authors deal with the subject in an exceedingly practical way, giving not only specimens of the books and forms required, but also a model set of transactions which should enable the student to obtain a thorough insight into the subject.—*The Accountant's Magazine.*

There can be no doubt of the practical usefulness of this work to everyone concerned in the keeping of gas accounts. It is well printed on excellent paper, and neatly bound in cloth.—*Huddersfield Examiner.*

For financial intricacy, the keeping of Gas Companies' accounts is hard to equal, and the publication of "Gas Companies' Book-keeping" is timely. This treatise deals in the most exhaustive manner with the keeping of gas accounts.—*Daily Mail.*

No pains have been spared by the Authors to make this book complete in every respect. The system of accounts recommended is not only a model of clearness, but also fully adequate to meet all reasonable requirements. Generally, the get-up of the book and of the various forms and specimen rulings shown therein is excellent. The work will be found both useful and reliable, while its convenience is greatly enhanced by the inclusion of an adequate index.—*The Accountant.*

Should be a useful work for Gas Companies. The work seems to us a model of exactness, simplicity, and clearness.—*Halifax Courier.*

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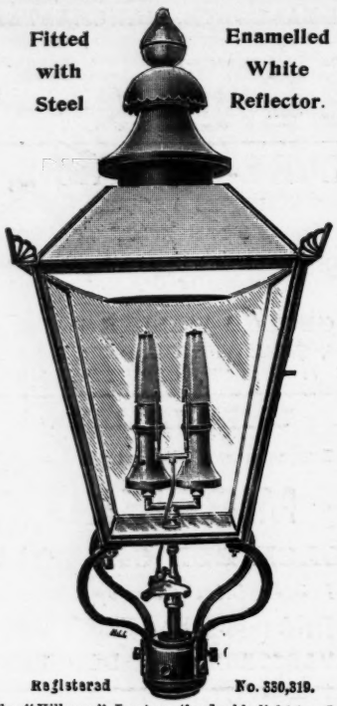

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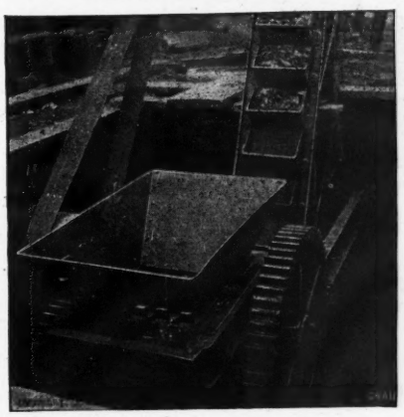
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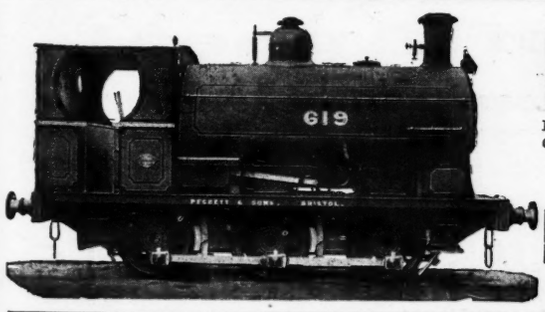
PHOTO, SHOWING ELEVATOR FOR COLD COKE.



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The Intensified Gas Light Company, Limited, WERE PROHIBITED by the terms of the license granted them by **The Welsbach Company from raising any objection to the validity of the Welsbach Patent—as follows: Clause 9. "The Licensees shall not at any time during the continuance of this License and Agreement, or afterwards, raise any objection to, or contest, the validity of the patents of the Welsbach Company hereinbefore recited."** Yet the **Welsbach Company were forced by the Court of Appeal** to agree to terms which were **satisfactory to the Intensified Gas Light Company.**

NOTE that the Welsbach Company has twice tried and failed to get an injunction against us in respect of the "Dura" Guaranty Mantle. In their first attempt they suffered a CRUSHING DEFEAT, for which they have already paid us. For their disastrous second attempt they as yet remain our debtors for our costs, which

The Court of Appeal

ordered the Welsbach Company to pay to us in any event.

We ask the Public and Trade to **resent misrepresentation. We** still **undertake to defend all Dealers and users** of our

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The United Chemical Works,
THE GUARANTY MANTLE COMPANY,
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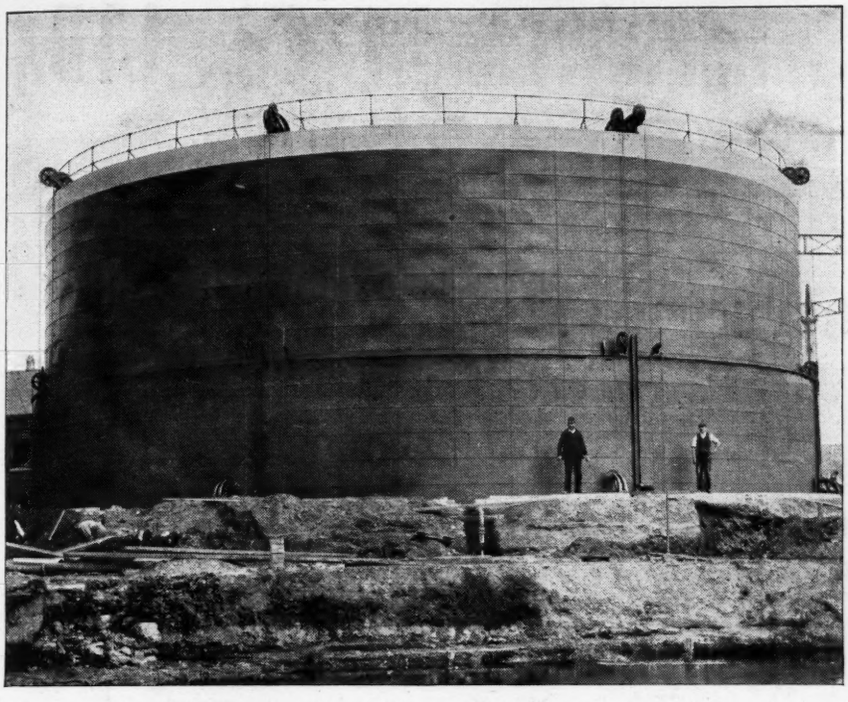
August 20th, 1901.

All Communications: Balham Hill, S.W.

Please report any interference by the Welsbach Company to our Solicitor, Mr. JONATHAN E. HARRIS, 95, Leadenhall Street, London, E.C.



Two-Lift Cable-Guided Gasholder, 80 ft. diameter by 20 ft. deep.
STAFFORD CORPORATION GAS-WORKS. (*From a Photo.*)

COPY OF TESTIMONIAL.

CORPORATION OF STAFFORD,
GAS & ELECTRICITY DEPARTMENT,
STAFFORD, *Feb.* 9, 1899.

Messrs.
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I am, sincerely yours,
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[SEE SUPPLEMENT TO THIS NUMBER.]

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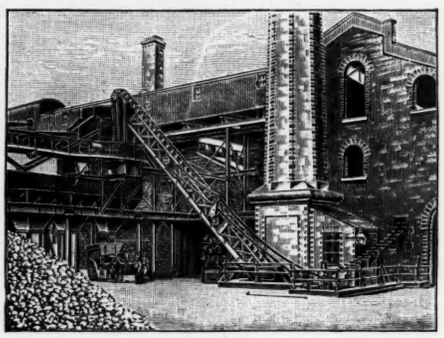

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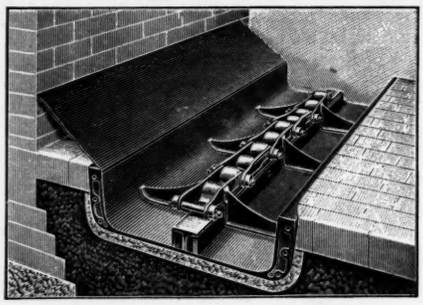
INTERIOR OF RETORT HOUSE SHEWING COKE CONVEYOR.



SECTION OF COKE CONVEYOR.

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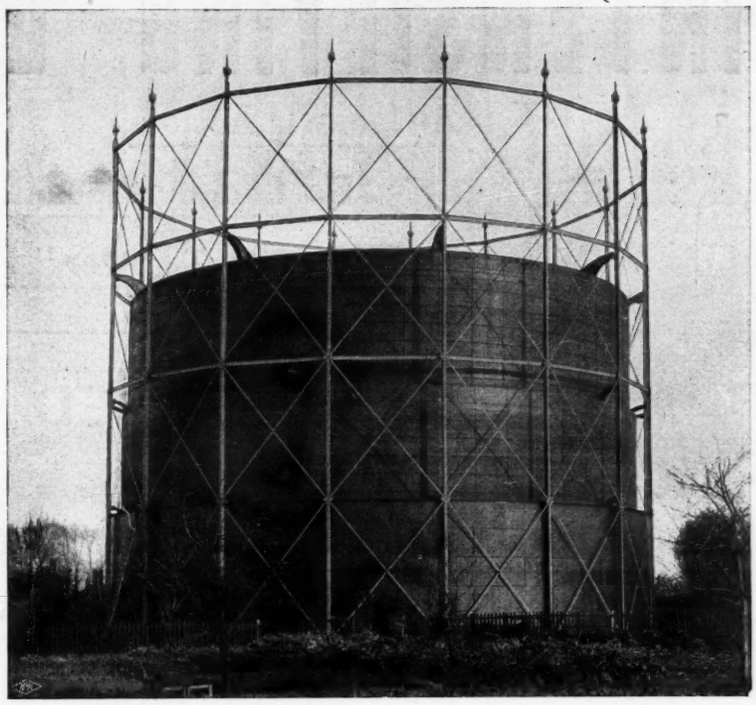
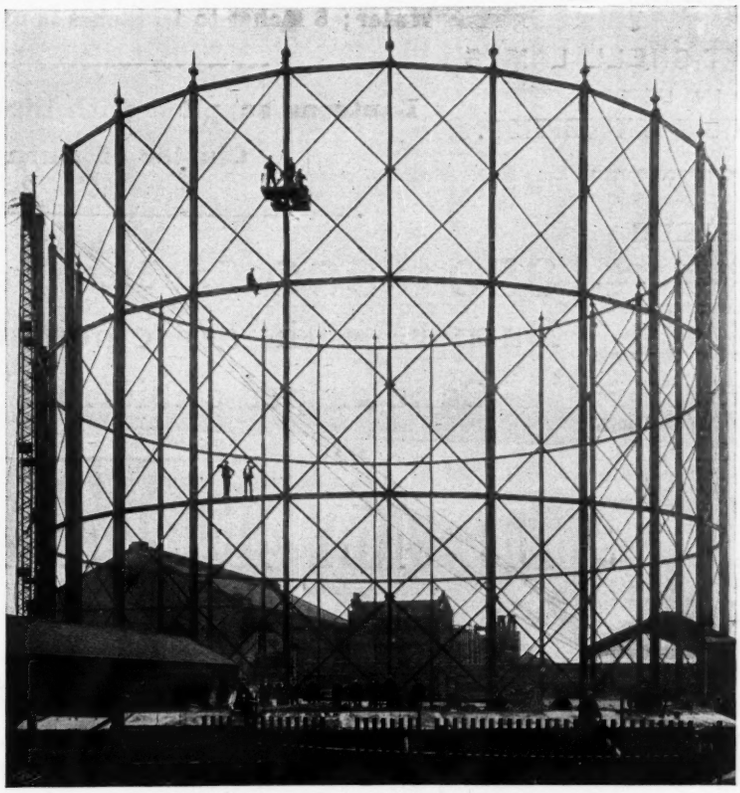


Three-Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.



Three-Lift Gasholder, 145 feet diameter by 35 feet deep, in course of construction for the WANDSWORTH & PUTNEY GAS COMPANY.

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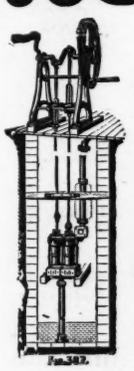

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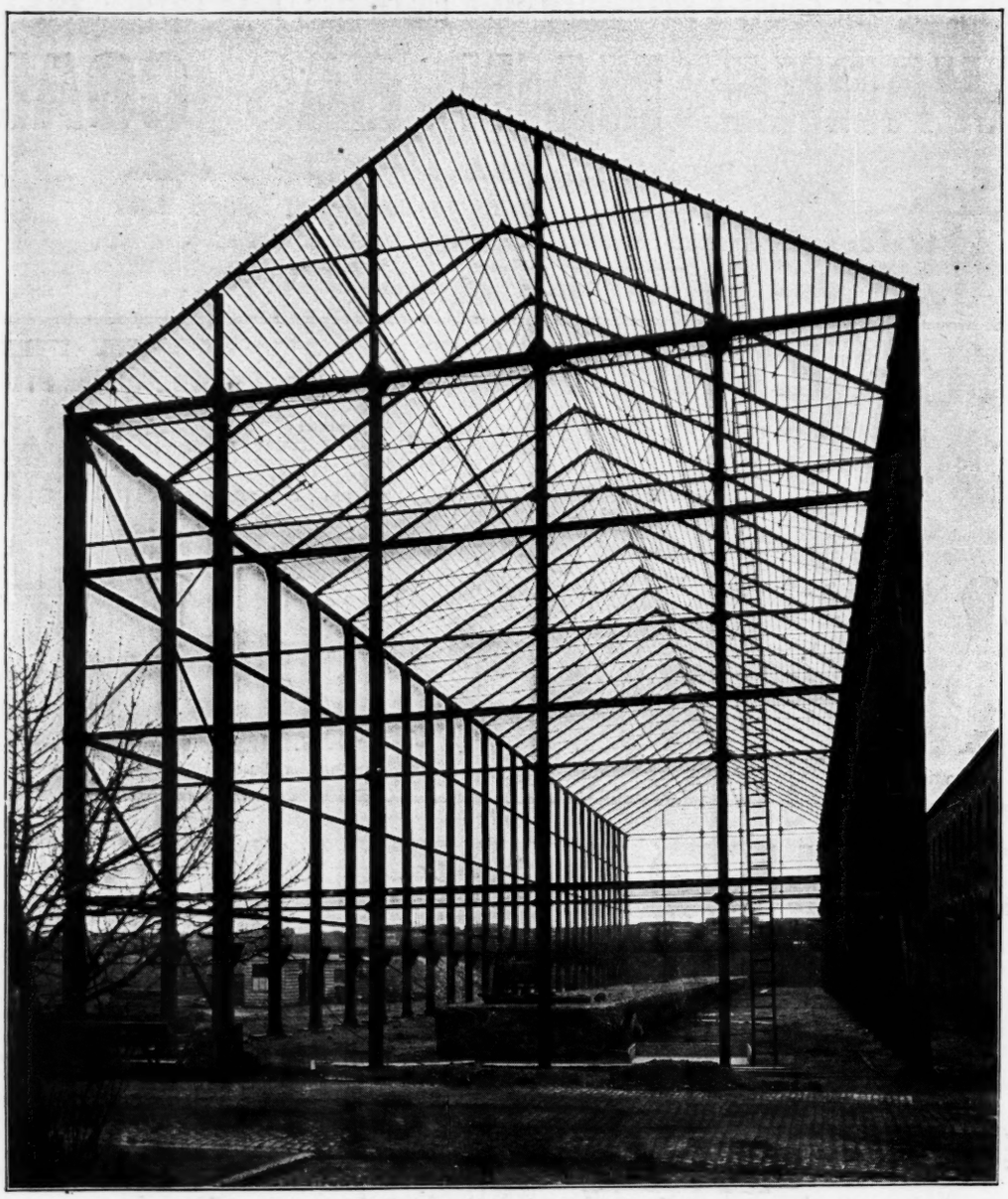

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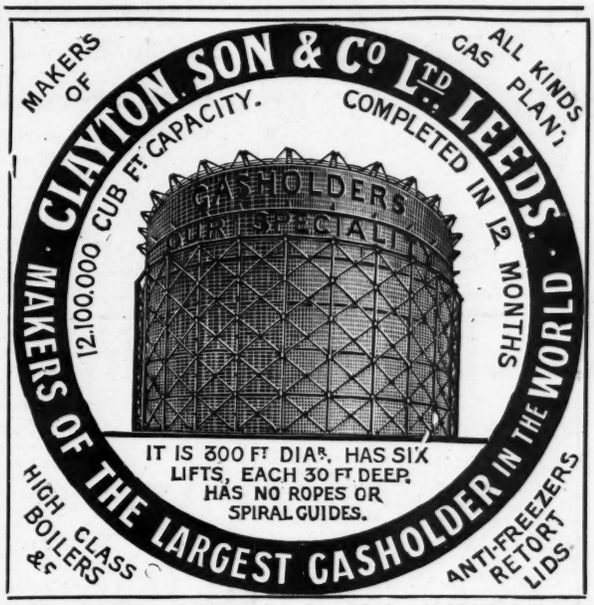
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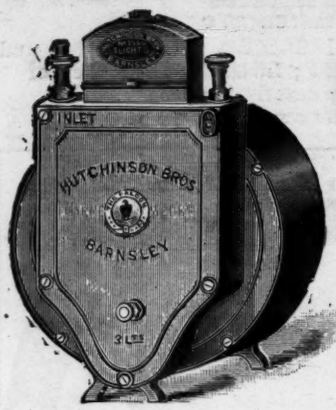

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